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Ohio Naturalist

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The O. S. U. Naturalist

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THE BIOLOGICAL CLUB OF THE OHIO STATE UNIVERSITY

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ANNOUNCEMENT.

In presenting THE O. S. U. NATURALIST to the public, a few words may not be out of place as to the motives and purposes which were instrumental in bringing it into existence. The Biological Club of Ohio State University is composed of professors, instructors and students of the several departments of natural history in the University. These departments have been carrying on certain lines of work for some time, and the more important and technical has been reported in various publications. Much of the work, however, which is only of local interest, but still of great value in the development of the natural history of the state, has had no convenient avenue of publication. For this reason it was thought advisable to begin a journal in a modest way in which such material together with other articles might be made available for immediate use.

The idea had been entertained for some time that such a course would be desirable. Several members had expressed themselves in favor of a journal, and Dr. Kellerman had for some years contemplated the publication of a purely botanical paper which should be devoted largely to the flora of the state. Finally during the spring of 1900 Mr. Tyler and Mr. Griggs, students connected with the club, began to arouse interest in the matter by advocating the founding of a bulletin which should provide a suitable avenue of publication. By a motion of the club, a committee to consider the matter was appointed, consisting of the following members:

Herbert Osborn,
W. A. Kellerman,
F. J. Tyler,
John H. Schaffner,
Max Morse,
R. F. Griggs.

This committee finally agreed upon a plan, which was presented to the club and adopted, with slight modifications, on the 7th of May, 1900. The editors are elected annually by the club, and following is the staff for the coming year:

Editor-in-Chief — John H. Schaffner, A. M., M. S.

Associate Editors — Zoölogy, F. L. Landacre, B. Sc.; Botany, F. J. Tyler, B. Sc.; Geology, J. A. Bownocker, D. Sc.; Archæology, W. C. Mills, B. Sc.; Ornithology, R. F. Griggs.

Advisory Board — Professor W. A. Kellerman, Ph. D., Department of Botany, Professor Herbert Osborn, M. Sc., Department of Zoölogy, Professor J. A. Bownocker, D. Sc., Department of Geology.

THE NATURALIST, while aiming to be strictly scientific and technical in character, will endeavor to be of especial assistance to the teachers and amateur scientists of the state. It is believed that the kind of work contemplated will be of great educational value.

While THE NATURALIST is to be devoted especially to the interests of the state, other matter which may from time to time be offered, will not be excluded.

In these days, when specialization is the tendency in all branches of knowledge, we think there is still room for the old-fashioned naturalist who was well versed in a number of sciences.

Whatever one's career may be, we believe that every scientist, and for that matter every person of education, should be a naturalist first and cultivate a broad general sympathy with nature, and only after that has he a right to become a specialist. No apology need therefore be made for the broad field which THE NATURALIST is to cultivate, and we present it to the public, earnestly soliciting the coöperation of university and college professors, high school teachers, students, and amateurs in the different branches of natural science, and asking that leniency of judgment which such enterprises merit when begun under special difficulties. Finally THE NATURALIST is not intended to be a money-making institution, but it will be improved and enlarged as rapidly as the income from subscriptions and other resources will permit.

J. H. S.

AN OHIO STATION FOR AMPELOPSIS CORDATA

W. A. KELLERMAN

(Plate 1.)

While collecting in Scioto County on the 8th of July, 1900, I was fortunate enough to come across an indigenous specimen of Ampelopsis cordata. [*]The station for the plant is on a hillside one mile east of Portsmouth, Ohio. The character of the environment is indicated in figure 8, plate 1, the plant in question growing on the bank by the roadside at a point immediately above the bicycle in the central part of the picture. The photograph from which the half tone was made shows only a portion of the high hills that border the Ohio river. The soil is clay and not regarded as very fertile. It is generally the case perhaps that this species grows in "swamps and along river banks," as stated in the manuals, but the ground here is high and dry.

[*] Since the MS. for this article was passed to the printer, the locality was again visited and several plants, some of large size, were found further up the hill-side.

The published statements as to the distribution of Ampelopsis cordata are not uniform. Riddell, in his synopsis of the Western Flora, says it occurs in the Alleghany Mountains west to Arkansas. Torrey and Gray, in the Flora of North America, Vol. 1, under the name of Vitis indivisa, give its distribution as Southern States west to Louisiana and Arkansas. Wood using the same name in his class-book, says Southern States to St. Louis. In Gray's Manual, last edition, the plant is given under the name of Cissus ampelopsis with the statement that it occurs in Virginia to Illinois and Southward. The occurrence as noted by Britton and Brown in the Illustrated Flora, makes the species still more decidedly southern, namely, southern Virginia to Florida, west to Illinois, Kansas and Texas. Prof Stanley Coulter, in a Catalogue of the Flowering Plants and Ferns indigenous to Indiana, published in 1899 in the 24th Annual Report of the Department of Geology and Natural Resources of Indiana, says this species occurs "in the central and southern counties of Indiana in swamps and moist woods."

In the fifth edition of Gray's Manual the range of this Ampelopsis (under the name of Vitis indivisa) was given as "West Virginia, Ohio and southward." In answer to an inquiry as to what in the Gray Herbarium was perhaps the basis for the reference to the Ohio distribution, Mr. Merritt L Fernald kindly wrote me as follows.— "I find in the herbarium a specimen of Cissus ampelopsis marked 'Ohio'. It is one of the old Torrey and Gray specimens and no further data are given."

Dr Millspaugh lists this species as Cissus ampelopsis in the Flora of West Virginia and adds on the authority of Mertz and Guttenberg that it also occurs in Ohio, near Wheeling. Upon inquiry of Supt Mertz, I learn that his notes of work upwards of twenty years ago contain no mention of this species at Wheeling, West Virginia, or at Bellaire, Ohio. He further informs me that what was taken for this Ampelopsis at Bellaire was probably Vitis cordifolia, three forms of which were found growing on the islands of the Ohio River near Wheeling. Of these he adds in a letter to the writer, 'I think we probably decided that one was V. indivisa, but I feel sure that it was not and you are probably the first to find it in Ohio."

It will be observed that the distribution as noted by Professor Stanley Coulter extends its range still further northward than my Ohio station. It is likely that its occurrence still further northward in Ohio may be detected by assiduous collectors.

I wish to say a word concerning the ornamental character of this native vine. The foliage is bright green and very handsome. A figure of a single leaf is shown in Plate 1, figure 2. This is reduced from a photograph taken with the leaf itself used as a negative. I have never detected a fungous attack or insect depredation on the leaves.

The small dull-colored bluish fruits in loose panicles when abundant are somewhat ornamental The vine is a vigorous grower and clings firmly to supports. Figure 4 shows a plant used for ornamental purposes growing on the south side of the Botanical Building at the Ohio State University A figure from a still more vigorous specimen was shown by Mrs Kellerman in Vick's Magazine, January, 1900 This was made from a photograph of a specimen growing at the north porch of a residence in Columbus, Ohio. The same has been reproduced by Dr. Halsted in Bulletin No. 144 of the New Jersey Experiment Station The species can be transplanted readily One of the plants just referred to was dug up in June in Linn County, Kansas, and easily survived its rough treatment Roots were taken from the Portsmouth plant in July this year and they are now growing and producing stems We have repeatedly transplanted specimens that were grown from roots and from cuttings in the green house and always with success

A word as to the synonomy should perhaps be given The species was described by Michaux in 1803 under the name of Ampelopsis cordata Persoon in 1805 proposed the name Cissus ampelopsis for the species It was unfortunate that he did not retain the specific name, cordata, for there seems to have been no need of discarding that part of its name even if the genus had been originally misapprehended Had he followed the most commendable usage of the modern systematists, he would have published the name in this form: Cissus cordata (Mx) Pers In 1811 Wildenow published the name as Vitis indivisa and here as before unnecessarily a new specific name was given. Many authors have regarded the plant as a Vitis rather than an Ampelopsis or a Cissus. We rely, however, on Dr Britton's authority and use the name Ampelopsis cordata, relegating the other names to synonomy.

Explanation of Plate I — Ampelopsis cordata Figure 1 A herbarium specimen of twigs in fruit, from a photograph Figure 2 A single leaf and tendril after a photograph direct from the same, reduced by the engraver Figure 3 View of the station for the indigenous specimen at Portsmouth, Ohio, the Ampelopsis is in the center of the picture immediately above the bicycle Figure 4 View of a plant growing on the south wall of the Botanical Building, Ohio State University, to the right of the door a portion of a Japan Ivy is seen

THE BAUM PREHISTORIC VILLAGE SITE.

W. C. Mills.

The field work of the Ohio State Archæological and Historical Society was completed August 18. The explorations were a continuance of last year's work at the Baum Prehistoric Village Site, which is situated in Ross County, Ohio, just across the river from the small village of Bourneville, and is located upon the first gravel terrace of the Paint Creek Valley. The village site surrounds a large pyramidal mound which was examined a number of years ago

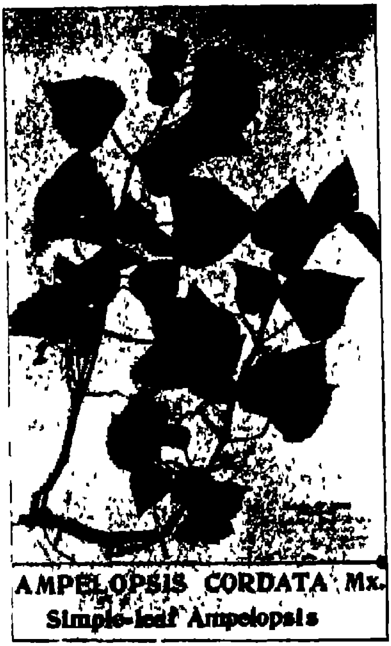

Fig. 1

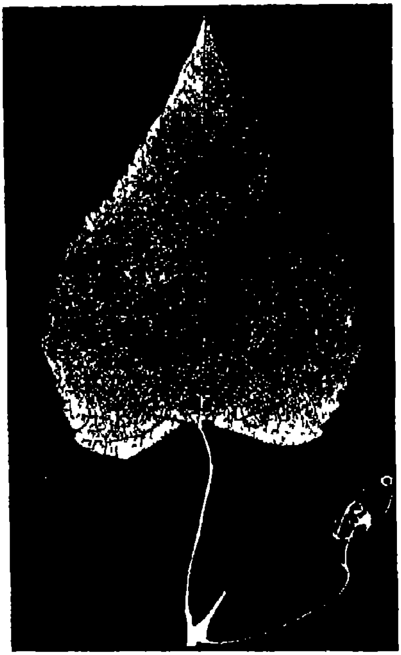

Fig. 2

Fig. 3

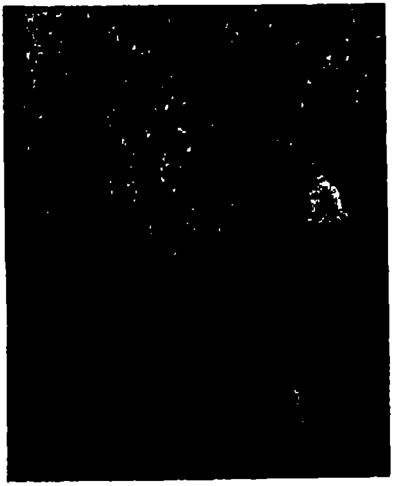

Fig. 4

KELLERMAN ON AMPELOPSIS CORDATA

under the direction of the Smithsonian Institution of Washington. A complete report of the explorations is found in the 12th Annual Report of the Bureau of Ethnology, 1890-91. At this time the village site was not explored but it was known to exist, as the following extract from the 12th Annual Report will show: "This mound is situated upon the edge of the first general bottom of Paint Creek, which though protected by a huge levee is annually inundated. In overflow times the smaller circle of the adjoining enclosure is almost entirely submerged, and the summit of the mound is the only land visible above a broad expanse of water. Around the mound upon all sides, particularly to the east, are traces of former Indian occupation Numerous fragments of pottery similar in fabrication and ornamental feature to those found in the mound bestrew the plowed ground These were intermingled with the valves of mussel shells, pitted stones, shell disks, human bones, arrowheads, pieces of perforated stone gorgets, and a large quantity of chipped flint" Directly north of this village site, about one mile distant is the noted hill top enclosure known as Spruce Hill, which overlooks the valley of Paint Creek for many miles north and south. The hill on which this enclosure is situated is about 500 feet high, and is a long narrow spur projecting from the tableland and extending to the south.

The wall of this enclosure is composed entirely of boulders and broken pieces of sandstone which had been collected along the margin of the summit of the hill. These sandstones are the result of disintregation of the sandstone strata which is near the surface on the hill top Directly east from the village site, a little more than 1800 feet, is what is known as the Baum works, which was surveyed by Squier & Davis in 1846 They described this work as the best preserved, and possessing gateways that are wider than those of any other earth-works found in this valley They also made a survey of the mound which is situated in this village site and they described it as a large, square, truncated mound, with a base of 120 feet and having a flat top, with an area 50 feet square. The mound at that time being 15 feet high. They also say that quantities of coarse broken pottery were found on and around the mound. Thus it will be seen that the early investigators found pottery surrounding the mound and later explorations by the Smithsonian Institution show that the broken pieces of pottery found on the surface surrounding the mound were very much like the pottery found in the mound and placed with the buried dead therein.

The object of the investigations carried on by the Archæological and Historical Society is to show the connection between the occupants of the prehistoric village and those who built the mound. This has been done by carefully comparing the contents of this village site with the contents of the mound as reported by the

Smithsonian Institution. So far, all of the pottery and implements of bone, stone, and shell that were buried in this mound, have been duplicated in great numbers from the refuse heaps, burials, and ash pits found in the village The village entirely surrounds the mound, but on the east it is more extensive and occupies upward of five acres of ground.

The work of examining the village site is very laborious. Every portion or particle of the earth to a depth, on the average, of two and one-half feet is carefully dug over with small hand trowels, and every particle of bone, shell or stone is carefully removed and examined The contents of the ash pits are screened so that no implements or ornaments may be lost The whole village site is platted, laid off in sections thirty-six feet square, which square is again laid off into sections four feet square. In this way every find is carefully located upon the map. This year the work was conducted east and north-east of the mound. Here the post-molds of their little tepees were found in abundance. Their fire-places usually were placed just outside of the tepees, and their refuse pits near at hand, and near by we found the burials. A series of photographs, showing the manner of burial and the close proximity of the burials to the ash pits and tepees, were carefully made At one time seven skeletons were exposed within an area of fifteen feet square Within this space two ash pits were found and one row of the post-molds, showing the relation of the little home to the burial ground The manner of burial is shown by the photographs taken of the seven skeletons exposed at one time, showing that they had no definite manner of placing the bodies, as some were buried at right angles to each other, some were placed at full length, and lying upon the back, while others were placed upon the side; in still other cases the body was evidently doubled up and then buried. A great number of skeletons of babies were found in the ash pits, showing that the already dug ashpit was the most convenient grave for the little one, who was then covered with ashes, consequently the skeletons were perfectly preserved With a great number of the adult skeletons were found implements of bone, such as awls, hoes, celts, arrow and spear points of stone, beads and ornaments of shell and bone; but with the skeletons of children varying in age from four to twelve years were found the greatest number of ornaments made of shell and bone. In one instance a large gorget made from the marine univalve Strombus gigas about two and one-half inches in diameter, was found upon the skeleton of a child six years of age. In another more than two hundred beads and ornaments of shell and bone were found upon the skeleton of a child not over seven years of age. In another grave a child not over four years of age had buried with it, what at one time was no doubt, a necklace made of elk teeth, perforated for attachment. In two instances the graves of children were carefully covered over with slabs of slate. With those children whose graves were carefully covered no implements or ornaments of any sort were placed. Of the sixty-three skeletons found, not a single perfect piece of pottery was found buried with them, differing greatly from the Madisonville Prehistoric Cemetery near Cincinnati, for at the latter cemetery quantities of pottery in their perfect state was found, buried with the skeletons. The pottery, implements and ornaments at Madisonville can be readily duplicated from the village at Paint Creek.

In the ash pits can be found specimens showing the masterpieces of art wrought in stone, bone and shell, representing the civilization which at one time inhabited this village Of the bone implements, the needle, made from the bones of the deer and elk is most beautiful in design, at the same time showing the skill displayed in the manufacture of the implements Some of them are upward of nine inches in length Of the bone specimens perhaps the bead is the commonest. In some pits more than two hundred have been taken out. In these ash pits were also found well wrought specimens of aboriginal fish hooks, also specimens showing the various stages of manufacture of this implement, which differs somewhat from the manufacture of those found at Madisonville, a full account of which appears in the 20th Annual Report of the Trustees of the Peabody Museum of Harvard University, by Prof. F. W Putnam, in which he fully describes the manufacture of the fish hooks found in the prehistoric village site. In no instance was an unfinished specimen found in the Baum Village which would, in any way, show that a hole was first bored through the bone and the fish hook then wrought from this hole as was shown by Prof. Putnam, on the contrary a piece of bone was selected and cut into shape representing a small tablet of bone two and one-half inches long by from one-half to three-quarters of an inch broad, with rounded edges at the ends. The center was then cut out by rubbing with a stone on each side. So that two fish hooks were made instead of one from the single piece of bone A great many perfect scrapers made from the metacarpal bone of the deer and elk were also found, while almost every pit would contain from one to four broken halves of these scrapers. Specimens were also procured showing the various stages in the manufacture of this implement which resemble very much in every particular those found at Madisonville, and also those found at the village site at Fort Ancient

The pottery fragments found in these ash pits resemble those found at Madisonville, in the ornamentation by incised lines, implement indentations arranged in figures, and handles ornamented with effigies of birds and animals Of the shell implements, perhaps the most common is the shell hoe, which is made from the mussel shell *Unio plicatus.*

A great number of beads, from one-half to one inch in diameter, made from mussel shells and perforated with from one to three holes, are found The large gorgets from two to two and one-half inches in diameter are also found. These are invariably perforated with from one to three holes, and are made from a shell foreign to the Paint Creek Valley.

Of the implements and ornaments made of stone, the flint arrow heads are very common These are mostly made from material brought from flint ridge in Licking County. Grooved axes are also found, the type prevailing is the one having the groove extend entirely around. The perforated gorgets of slate are also found, but the most interesting of the stone implements found in the pits are the perforated discoidals. These are all small, varying in diameter from two to three inches, and finely polished

In the refuse heaps and ash pits were found the bones of the animals used for food, charred corn, hickory nuts, walnuts, butter nuts, acorns, hazel nuts, beans, seeds of the papaw, wild plum, etc About thirty-five per cent. of the bones taken from these pits were of the Virginia deer The bones of the black bear, raccoon, elk, ground-hog, wild-cat, muskrat, squirrel, beaver, wild turkey, wild duck, wild goose, trumpeter swan, great horn owl, barred owl, were found in abundance. But perhaps the most interesting of the animal bones found were those of the Indian dog Skulls and parts of skeletons were taken from the pits in great numbers. Professor F W Putnam, of Harvard University, who has been making a study of the skulls of the dog taken from the mounds and burial places of Florida, Georgia, South Carolina, Ohio, Kentucky, New York, and from the great shell heaps in Maine, says that a distinct variety or species of dog was distributed over North America in pre-Columbian times, and by comparison he finds that the dog found in America is the same variety of dog found in the ancient site of the Swiss Lake dwellers, and also in the ancient tombs of Thebes in Egypt, and claims that the variety of the pre-Columbian dog is apparently identical with the pure breed Scotch collie of today, while Mr F A. Lucas, of the U. S National Museum, describes the dog found in the Baum Village as resembling very much the bull terrier in size and proportion, and states that the same species have been found in the village sites in Texas and the old Puebloes

A FOLIICOLOUS FORM OF SORGHUM SMUT AND NOTES ON INFECTION EXPERIMENTS.

W. A. KELLERMAN

(Plate 2.)

On January 1st, 1900, several pots in the Botanical greenhouse of the Ohio State University were planted to sorghum, Kaffir corn, maize, sweet-corn and pop-corn. The seeds were previously moistened and mixed with a large quantity of head-smut of sorghum taken from smutted sorghum plants also from maize infected with the same fungus. This species was named *Ustilago reiliana* by Kühn in 1868 from specimens collected in Egypt.

The plants developed rapidly and normally, though the stems were slender and did not reach the normal height. The panicles appeared early and only in a comparatively few cases showed infection.

In one case an anomalous specimen appeared, namely, a sweet corn plant with the upper leaves as well as the panicle infected. This form therefore differs from the type in being in part foliicolous and may be designated as *Ustilago* (*Cintractia**) *reiliana* forma *foliicola* nov., for Figures 1 and 2, Plate 2, show the appearance of the infected plant, the one representing an earlier and the other a later stage of the emergence of the smut mass.

It may be remarked further that I have repeatedly tried seed inoculation experiments, mostly in the greenhouse but also occasionally in the field.

In the latter case in the summer of 1900, I obtained from a plot of many hundred stalks including field-corn, sweet-corn, pop-corn, sorghum, Kaffir corn and broom corn only three cases of smutted plants. These were of sweet corn, both the tassel and ear being affected. The previous year about the same per cent of successful inoculations were obtained. But in the greenhouse the experiments have uniformly resulted in the production of a considerable number of smutted stalks of sorghum and occasionally an infected plant of maize. These have for the most part been reported in print, the first account appearing in Bulletin No. 23, Kansas Experiment Station, in the year 1891.

I have now growing in the botanical greenhouse three sets of sorghum plants raised from seeds planted January 1, 1898, January 1, 1899, and January 1, 1900. Only the plants have been retained which showed successful inoculation experiments. They have been shifted to larger pots from time to time, but the plants make only a stunted growth. The new stalks that appear now and then are invariably affected, though sometimes one of the panicles, either the one terminating the main stem or one of the side branches may be free from visible smut. It is thus evident that this species of smut is perennial where its host lives from year to year. Figure 3 shows a photograph of one of the plants started in the greenhouse in 1899, its first stem producing an infected panicle. Figure 4 shows a plant grown in 1900, the first or central panicle not exhibiting the smut, but later when panicles from the side branches appeared, they were seen to be smutted.

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*Mr. G. P. Clinton regards this fungus as a Cintractia rather than an Ustilago.

It seems that another experimenter, whom I will quote, has succeeded scarcely as well. Mr. G. P Clinton, the assistant Botanist of the Illinois Experiment Station, Urbana, Illinois, in Bulletin No. 57 (March, 1900) reports as follows: "Apparently from the experiments of Kellerman, infection takes place through the germinating seed, though the per cent. of infection he produced was rather small. In '98 field experiments were conducted here with a view of infecting the Orange variety of sorghum with this smut. In one case the seed was mixed with an abundance of spores and in others these spores were sprayed in water or manure water on the young parts of the plants when about six inches high. In none of the several hundred plants that matured was any sign of the smut found It is very likely that the variety used may have had something to do with the negative results, as it was not the same from which the smut was taken."

The head-smut of sorghum is not to be confused with another species that occurs on the same host. The one now referred to is a grain-smut, that is, the panicle as a whole is not included, but the individual grains become smutted. This species has been called *Ustilago sorghi*, but Mr Clinton regards it as a Cintractia, namely, *Cintractia sorghi-vulgaris* (Tul) Clint. It is more common than the former, occurring often on sorghum and broom corn.

The head-smut of sorghum, *Ustilago* or *Cintractia reiliana*, was first found in this country by Prof J. T Willard at Manhattan, Kansas, in 1890, in a plot grown for purposes of chemical investigation. The same year it was detected by Dr. Halsted in New Jersey. I found it in Ohio in 1897 and it is now reported for Illinois by Mr. Clinton. In all these cases it occurred only on sorghum, but Prof. Hitchcock has reported it as not uncommon on maize in fields about Manhattan, Kansas.

EXPLANATION OF PLATE 2 —Ustilago or Cintractia reiliana Figure 1 The foliicolous form occurring on sweet corn, the panicle not yet emerged, but the smut on upper leaves in sight Figure 2 Same as in Figure 1, showing a later stage of maturity Figure 3 An infected sorghum plant in the greenhouse, photographed in 1899, the panicle smutted Figure 4 An infected sorghum plant, grown in the greenhouse in 1900, the central panicle sound, the later (side) panicles smutted

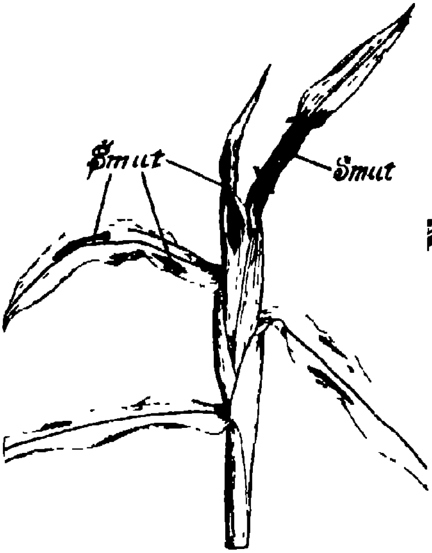

Fig. 1

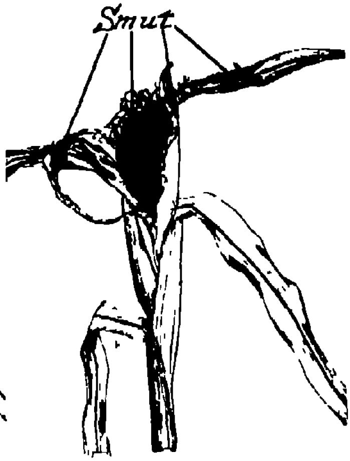

Fig. 2

Fig. 3

Fig. 4

KELLERMAN ON SORGHUM SMUT.

A LIST OF HEMIPTERA COLLECTED IN THE VICINITY OF BELLAIRE, OHIO.

HERBERT OSBORN.

The following record of species represents the collections of Hemiptera made during four days (Aug. 28, Sept. 1, 1900) at points within five miles of Bellaire, all on the Ohio side of the river. Wooded hillsides, valleys, creek bottoms and shore and island of the river were worked during a part of each day and as the list includes one hundred and forty-nine species, it is probably fairly representative for the common species of the season.

HOMOPTERA.

Cicadidæ Cicada tibicen L One specimen found dead.

Membracidæ. Entilia sinuata Fab., Publilia concava Say, Ceresa diceros Say, Ceresa bubalus Fab., Thelia bimaculata Fab., Acutalis calva Say, Vanduzea arcuata Say.

Fulgoridæ Scolops sulcipes Say, Scolops sp., Ormenis pruinosa Say, O. septentrionalis Fab., Amphiscepa bivittata Say, Bruchomorpha dorsata Fh., B. oculata Newmn , Issus ? sp Pissonotus ater VanD , Stobera tricarinata Say, Stobera sp., Liburnia campestris VanD., L. ornata Stal, Liburnia sp.

Cercopidæ. Lepyronia 4-angularis Say, Clastoptera obtusa Say, C proteus Fh., C. xanthocephala Germ.

Bythoscopidæ. Macropsis apicalis O&B., Agallia sanguinolenta Prov., A. 4-punctata Prov., A. constricta VanD., A. novella Say, Idiocerus pallidus Fh., I. snowi G&B., I. verticis Say.

Tettigonidæ. Aulacizes irrorata Fab., Tettigonia bifida Say, T. tripunctata Fh., T. gothica Sign. T. hartii Wdw. (mss), Diedrocephala coccinea Forst., D. mollipes Say, Helochara communis Fh., Gypona octolineata Say

Jassidæ. Xestocephalus pulicarius VanD., X. tessellatus VanD., Platymetopius acutus Say, P. frontalis VanD , Deltocephalus sayi Fh., D. sylvestris O. & B., D. apicatus Osb., D. weedi VanD., D. obtectus O. & B., D. inimicus Say, D. flavicosta Stal, D nigrifrons Forbes, Scaphoideus immistus Say, S. auronitens Prov., S scalaris VanD., Athysanus curtisii Fh., A (Limotettix) exitiosa Uhl., Athysanella acuticauda Bak., Lonatura catalina O & B., Eutettix seminudus Say, Phlepsius irroratus Say, P. decorus O. & B., Thamnotettix clitellarius Say, Chlorotettix unicolor Fh., C. galbanata VanD., Jassus olitorius Say, Cicadula 6-notata Fall., C. punctifrons Fall., Gnathodus punctatus Thunb., G abdominalis VanD., Empoasca smaragdula Fall., E. obtusa trifasciata Gill , E. mali LeB., Dicraneura flavipennis Fab., Typhlocyba comes vitis Harr., T. comes basilaris Say, T. comes comes Say, T. c. ziczac Walsh, T. obliqua Say, T. vulnerata Say, T. tricinta Fh., T. trifasciata Say, T. querci bifasciata Gill., T. hartii Gill.

Aphididæ. Pemphigus populi transversus Riley, On Cottonwood.

Aleyrodidæ. Aleurodes sp. Abundant on Sycamore leaves.

Coccidæ. Chionaspis salicis Harr.

HETEROPTERA.

Cydnidæ. One specimen as yet undetermined.

Pentatomidæ. Podisus cynicus Say, Brochymena annulata Fab., Cosmopepla carnifex Fab., Euschistus fissilis Uhl., E. tristigma Say, E. variolarius P Beauv., Trichopepla semivittata Say, Thyanta custator Fab.,

Coreidæ. Neides muticus Say, Jalysus spinosus Say, Corizus lateralis Say, C. nigristernum Sign., C. bohemani Sign., (?) C. noveboracensis Sign

Lygaeidæ. Nysius thymi Wolff, N angustatus Uhl., Orsillacis producta Uhl., Ischnorhynchus didymus Zett., Blissus leucopterus Say, Cymus angustatus Stal. Geocoris limbatus Stal, G. fuliginosus Say, Myodocha serripes Oliv., Ligyrocoris sylvestris L., Ptochiomera nodosa Say, Lygaeus kalmii Stal, L. turcicus Fab.

Capsidæ. Megalocoerea debilis Uh. (?), Miris affinis Reut., Compsocerocoris annulicornis Reut., Calocoris rapidus Say, Lygus pratensis L., L. plagiatus Uhl., Poecyloscytus basalis Reut., Camptobrochis nebulosus Uhl., Eccritotarsus elegans Uhl., Hyaliodes vitripennis Say Episcopus ornatus Uh., Ilnacora stalii Reut., Pilophorus bifasciatus Fab , Malacocoris irroratus Say, Garganus fusiformis Say, Halticus uhleri Giard, Styphrosoma stygica Say, Neoborus laetus Uhl., Plagiognathus obscurus Uhl., Plagiognathus sp., Agalliastes associatus, Uhl.

Acanthiidæ Triphleps insidiosus Say.

Tingitidæ. Corythuca ciliata Say

Phymatidæ. Phymata fasciata Gray.

Nabidæ. Coriscus ferus L.

Reduviidæ. Sinea diadema Fab., Acholla multispinosa DeG., Diplodus luridus Stal.

Hygrotrechidæ. Hygrotrechus remigis Say, Stephania picta H. Schf

Saldidæ. Salda interstitialis Say.

Corisidæ. Corisa alternata Say.

Of the above list nearly thirty have not been recorded for the state hitherto and there are a few specimens which are as yet undetermined.

ADDITIONS AND CORRECTIONS TO THE "ODONATA OF OHIO."

JAMES S. HINE.

Since the publication of the Odonata of Ohio, there have been several species of dragonflies added to the State list, and we have had reasons to change our minds regarding the identity of two species at least.

Enallagma Fischeri, Kellicott, is a synonym of Agrion antennatum, Say, consequently the species will henceforth be known as Enallagma antennatum, Say.

Our Gomphus lividus, Selys, is Gomphus sordidus, Selys, and Gomphus externus, Selys, is Gomphus crassus, Hagen.

The following species have been added·

1. Lestes eurinus, Say, taken June 3, 1900, by E B. Williamson in Portage County. Numbers of both males and females of the species were taken on Cedar Point, at Sandusky, July 10 of the present year.

2. Progomphus obscurus, Ramb., first taken at Ironton, June 1, 1899, by R. C. Osburn. The present year I took several specimens at Vinton, June 10th.

3. Gomphus abbreviatus, Hagen, (?) was taken at Loudonville, June 10, 1899, by J. B. Parker and R C. Osburn. The species was common at the same locality June 14, of the present year.

4. Neurocordulia obsoleta, Say, has been taken at Cincinnati by Chas. Dury and his associates for three consecutive seasons.

5. Neurocordulia yamaskanensis, Prov., was procured on Rattlesnake Island in Lake Erie, June 28, 1900, by Prof Osborn.

6. Nasiæschna pentacantha, Rambur, was taken near Kent, Ohio, June 21, 1900. In company with R. C Osburn we procured three pairs of this species. Others were seen.

DRAGONFLIES TAKEN IN A WEEK.

RAYMOND C. OSBURN AND JAMES S. HINE.

During the week beginning June 17th, we collected insects and fishes in the region of small lakes near Kent, Ohio. A list of the Odonata taken during that week is interesting, as it shows the richness of the Odonat fauna of north-eastern Ohio and also the number of species of this group that may fly in a certain locality at the same time.

1. Calopteryx maculata, Beauv.
2. Colopteryx æquabilis, Say.
3. Hetærina americana, Fabr.

4. Lestes uncatus, Kirby.
5. Lestes rectangularis, Say.
6. Lestes vigilax, Hagen.
7. Lestes inequalis, Walsh.
8. Argia putrida, Hagen.
9. Agria violacea, Hagen.
10. Argia tibialis, Rambur.
11 Argia apicalis, Say.
12. Erythromma conditum, Hagen.
13. Nehalennia posita, Hagen.
14. Nehalennia irene, Hagen.
15. Amphiagrion saucium, Burm.
16. Enallagma traviatum, Selys.
17. Enallagma civile, Hagen.
18. Enallagma carunculatum, Morse.
19. Enallagma hageni, Walsh
20. Enallagma geminatum, Kel.
21. Enallagma exsulans, Hagen.
22. Enallagma antennatum, Say.
23. Enallagma signatum, Hagen.
24. Enallagma pollutum, Hagen
25 Ischnura verticalis, Say
26. Ophiogomphus rupinsulensis, Walsh.
27. Gomphus dilatatus, Rambur
28. Gomphus quadricolor, Walsh.
29 Gomphus fraternus Say
30 Gomphus furcifer, Hagen
31. Gomphus spicatus, Selys.
32. Gomphus sordidus, Selys
33. Gomphus exilis, Selys
34 Dromogomphus spinosus, Selys.
35. Anax junius, Drury
36. Basiæschna janata, Say.
37 Epiæschna heros, Fab.
38. Æschna verticalis, Hagen.
39. Nasiæschna pentacantha, Rambur.
40. Macromia illinoiensis, Walsh.
41 Epicordulia princeps, Hagen.
42. Tetragoneuria cynosura, Say.
43. Tetragoneuria semiaqua, Burm.
44. Tramea lacerata, Hagen.
45. Libellula basalis, Say.
46. Libellula pulchella, Drury.
47. Libellula semifasciata, Burm.
48. Libellula exusta, Say.
49. Libellula incesta, Hagen.

50. Plathemis trimaculata, DeGeer.
51. Celithemis eponina, Drury.
52. Celithemis elisa, Hagen.
53. Celithemis fasciata Kirby.
54. Leucorhinia intacta, Hagen
55. Sympetrum rubicundulum, Say.
56. Perithemis domitia, Drury.
57. Mesothemis simplicicollis, Say.
58. Pachydiplax longipennis, Burm.

Number 2 was taken for the second time in the State. The species was common along the Cuyahoga River, where both males and females were found resting on foliage near the water's edge or flitting nervously from one resting place to another.

Number 27 is one of our rarer Gomphids. Only one specimen of the species was taken.

Both male and female of 30 were taken. This is the first time the female of this species has been taken in Ohio

Number 39 was taken for the first time in Ohio. Three pairs of this fine species were taken.

Two years ago I took males of number 48 at Stewart's Lake. The species has not been taken in the State since until this year when we took both males and females at the same lake.

Number 58 has been considered a very desirable species, but it seems that it is a common form in the lake region near Kent. About thirty specimens were procured.

ADDITIONS TO THE OHIO FLORA.

The Fourth State Catalogue of Ohio Plants published in April, 1899, by Kellerman, contained 2025 species of Cormophytes. In the first Annual Supplement, published April, 1900, 69 additions were made. The following 22 additional species therefore bring the total to 2116 plants growing without cultivation in the state. The numbers correspond to the Fourth State Catalogue so that those who desire can easily copy the additions and bring their catalogue up to date.

212a Bouteloua hirsuta Lag. Hairy Mesquite-grass. Ohio State University Campus, Columbus F J. Tyler.

212b Bouteloua oligostachya (Nutt.) Torr. Mesquite-grass. Ohio State University Campus, Columbus. Alice Dufour.

255a Bromus asper Murr. Hairy Brome-grass (London, Mrs. K. D. Sharp, Coll., E Monroe, Highland Co., W. A. Kellerman, Coll.) Alice Dufour.

255b Bromus breviaristatus (Hook.) Buckl. Short-awned Chess Ashtabula, (W. A. Kellerman, Coll.) Alice Dufour.

472a Wolffia brasiliensis Wedd. Brasil Wolffia. Sandusky Bay. Abundant at times. R. F. Griggs.

588a Convallaria majalis L. Lily of the Valley. Abundantly escaped in Cemetery, Worthington. R. F. Griggs.

619a Salix nigra x amygdaloides. A D. Selby, 8th Report Academy of Science, p. 22, and others.

629 Change S fluviatilis Nutt. to S. interior Rowlee. Rowlee in Bull. Torr. Bot. Club. 27: 247, 1900.

629a Salix interior var. wheeleri Rowlee. Cedar Point, W. A. Kellerman and R. F. Griggs

636a Salix sericea x cordata Ashtabula (W A. Kellerman Coll.) R F. Griggs

637a Salix petiolaris var gracilis. Toledo. (J. A. Sanford, Coll. 1879,) R. F Griggs.

638a Salix candida x cordata. Castalia, Erie County. R. F. Griggs.

864a Berberis aquilifolium. Pursh. (Mahonia aquilifolium Nutt.) Seeding in Cemetery, Worthington R. F Griggs.

898b Diplotaxus muralis (L.) DC Diplotaxus Cleveland, Ohio. Wm. Krebs.

963 Philadelphus inodorus L. Mt. Pleasant, Jefferson County. W. A. Kellerman.

1039a Cratægus cordata (Mill.) Ait Washington Thorn. Steubenville, Ohio. H. N. Mertz.

1045a Cratægus multipes n. sp (W. W. Ashe in Bulletin 175 N. C. Experiment Station, August, 1900.) Ohio, E. E. Bogue, Coll.

1182a Dolichos lablab L Hyacinth Bean Escaped from cultivation in several places in Columbus. Found growing on vacant lots, surrounded by large weeds. John H. Schaffner.

1188a Rhus cotinus L. Escaped, Mt Pleasant, Jefferson County. W. A. Kellerman.

1219a Ampelopsis cordata Michx. Scioto County. Previously reported for Ohio. W. A. Kellerman.

1255 Lechea minor L. Steubenville, Ohio H. N. Mertz.

1487a Gilia coronopifolia Pers Growing in a cemetery near Madison, Lake County. Spreading slowly. F. J. Tyler.

1729 Euphorbia lathyris L. Pomeroy, Meigs County. W. A. Kellerman.

1919a Polymnia canadensis var. radiata Gray. Cedar Point. Very abundant. R. F. Griggs

1948a Helianthus maximiliani Schrad. Sandusky. A single plant along railroad tracks. R. F. Griggs.

COLLECTING AND PRESERVING MICROSCOPIC PLANTS.

Small plants like Desmids, Diatoms, etc., may be preserved in water, in homeopathic vials, provided a drop of carbolic acid is added to each bottle of material. In this way they will keep for a long time with very little change of color and contents.

J. H. S.

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FEEDING HABITS OF THE SCARLET FLAMINGO.

J. C. HAMBLETON.

One of the favorite winter haunts of *Phoenicopterus ignipalliatus* is found on the sandy beaches that abound on the west coast of South America, at about latitude 42° South.

On the north coast of the large island of Chiloe, there are several places of this sort where these beautiful birds may be seen in flocks of hundreds during the months of June, July and August, the winter months in that region.

I remember the first time I walked over one of their favorite resorts. It was on the Pudeto river, near the small town of Ancud. The tides here are rather high owing to the formation of the bay, and as a consequence it enters the river and floods great stretches of sand that border the left bank. As the tide goes out the flamingos may be seen here by hundreds. The first time I visited the place the tide had been out some hours and there were no birds to be seen. I was disappointed for the trip had been made for that special purpose.

However my attention was soon attracted to long rows of small hillocks of sand, or rather, to be more exact, circular ditches in the sand that appeared to have been made while the water was still present. These were about two or two and one-half feet in diameter by five or six inches wide and three or four inches deep. This, of course, gave the central portion the appearance of a small hill about eighteen or twenty inches in diameter. Upon inquiry I could get no information—no one had any idea how or by whom they had been made.

A few days later the mystery was solved when a second visit was made to the place at a more propitious moment.

Upon approaching to within a few hundred yards of where a regiment of these scarlet beauties was lined up, the birds took flight and it was then that I discovered who were the authors of my mysterious little hills.

By subsequent observations I found that the birds took their stand in the water when it was about a foot and a half deep, and at more or less regular intervals about eight or ten feet apart. Here they remained stationary and turned round and round with their heads under water, catching the small crustacians that seem to be their principal diet. The form of their beak is such that when it is placed on the ground the upper mandible is underneath. This being large and strong, soon opens up the circular depression that first called my attention. Before the tide is all out they usually leave because the crustaceans have by this time bidden in the sand.

The flamingo frequents this coast only during the winter months and consequently does not nest here, nor is it known to nest west of the Andes mountains. Their nests and young, however, have been observed in great numbers in the small lakes of brackish water that abound on the plains of Patagonia east of the monntains. Undoubtedly these are the same birds that spend their winters in Chile, the lofty Andes proving no barrier to their flight. There are many roads by which they can pass, the mountains being intercepted by frequent rivers that empty into the Pacific, and have their origin beyond the snow-covered Andes, in the plains of the Argentine Republic.

AGGRESSIVE CHARACTER AND ECONOMIC ASPECT OF THE WHITE HEATH ASTER.

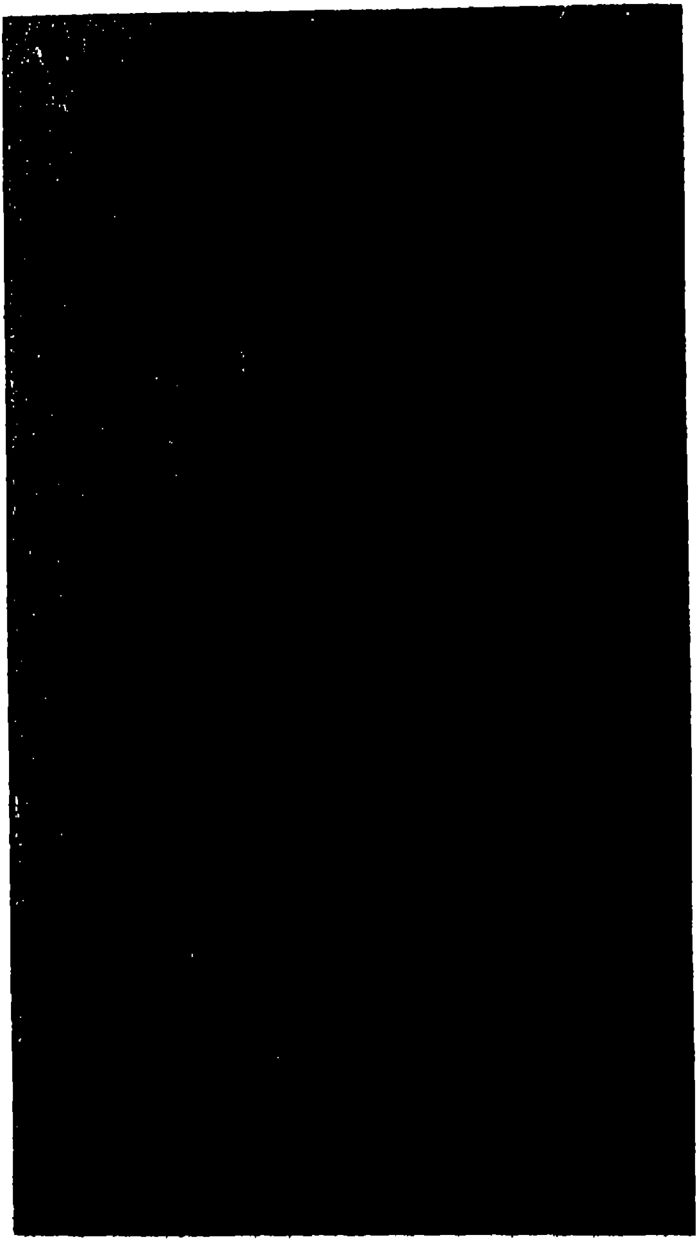
W. A. Kellerman.

(Plate 2)

The White Heath Aster (Aster ericoides) is an indigenous species whose distribution is given in our manuals as "Canada, Florida, and the Mississippi," "Maine and Ontario to Florida, west to Wisconsin and Kentucky," and "South New England to Minnesota and southward," the variety *pilosus* "mainly in the Western States." It is one of the commonest Asters throughout Ohio, occurring doubtless in every county in our State. The variety *pilosus* seems to be the common form in our region, and may be seen growing in rich and poor soil with almost equal thrift, and occurring in all habitats except the woods and swamps.

Its capacity for adaptation to the advance of civilization is remarkable, and this occasions the remark now very generally heard among the farmers that it is a "new weed in the region," "not known here five years ago," "just came all at once," "the latest and worst weed we have," and other expressions of similar import. As a matter of fact, the roadsides in many places are lined with it, fields with a poor stand of clover, timothy, or blue grass are completely covered with it, and all waste places, vacant lots, and neglected spots are profusely decorated with the same.

The plant is a rather coarse weed; but in spite of this fact it is somewhat attractive because of the masses of green foliage and the white flowers that become prominent before the summer is gone, and last throughout the early and middle autumn. The stems are tough



and wiry and this gives the local name "Steelweed," a common designation in Adams County and adjoining regions. It is said by some, however, that this name is given it "because the flowers are the color of bright steel." Another name frequently applied in the localities mentioned is "Bee-plant" for reasons suggested in the name itself, and still another is "Stickweed," for which I could learn no explanation. Other common names which Britton enumerates are Frost-weed, Michaelmas Daisy, Farewell Summer, White Rosemary, Dog-fennel, Mare's-tail, and Scrub-bush.

Though complaint against this plant is universal in some sections, it is not, I think, well founded in all cases. It has some merits now and then acknowledged by those who are close observers. The allegations pro and con may be summarized as follows:

First, the statement is made that it is "driving out every other grass" and "invading" the whole country. It is certainly more abundant than it was before the country was cleared and cultivated; yet after all but little of it is seen in good pastures and vigorous meadows, and none at all in ground that is under thorough and constant cultivation. It has not the aggressiveness possessed by some of our weeds, but it does quickly take possession of neglected and fallow ground. It does not spread extensively or rapidly by underground stems as do some of the Compositae. It has simply short rootstocks for this purpose. Its mode of multiplication by this means is illustrated in the figures shown in Plate 8 These are from photographs taken late in November, and indicate the preparation the plant makes for the next season's work. The specimens numbered 1 and 2 had been mowed to the ground during the summer. But this instead of killing the plants stimulated their propensity to vegetative multiplication. The result was therefore the opposite of what the farmer intended. Figure 3 shows a plant undisturbed during the growing period, and its energies active and latent were almost entirely exhausted in producing flowers and seed. Let the plants alone then rather than shear their tops, and the sooner will they exhaust themselves.

It is true, as the figures plainly suggest, that this Aster is not a difficult one to eradicate. While the roots are numerous, they are not long; and even the shallowest plowing or ordinary cultivation will effectually destroy the plant. As to multiplication by seed germination, it needs simply to be remembered that good or even fair cultivation of the soil will prevent this weed from growing, and that many species of weeds will get in old meadows and pastures as rapidly as the cultivated grasses are killed by excessive grazing or the casualties of season and climate.

In the second place the weed is charged with the heinous crime of "killing stock." Thorough inquiry in different localities established the fact that this plant, eaten to considerable extent late in the season by cattle and horses it is true, does damage perhaps only as the consumption of an excessive amount of almost any kind of dry and comparatively innutritious vegetable matter might do. It is said to be especially binding, and the constipation no doubt was a factor in bringing about the fatal results that were cited. While stock will eat the plant when at hand they take but little of it if nutritious grasses can be found. A very intelligent and observant farmer, however, was seen cutting and burning the plants which covered his pastures to save his stock—his neighbor by carelessness in this respect, he averred, having lost some valuable horses.

On the other hand this White Heath Aster is an important bee-plant. Bees will "work on it the whole day," and the plant is in bloom from middle of late summer to late autumn The honey made is white, and has a strong tendency "to turn to sugar." One farmer who has two hundred and fifty stands of bees, now that this Bee-plant is well established as a sure crop, will sow no more buckwheat for his bees.

I have said this species is becoming excessively abundant in some (hilly) portions of southern Ohio. It can well be regarded as "a great boon" merely because it is a soil-binder of marked efficiency. It prevents the destructive washing of the hillsides in the Fall, open winter and early spring. Such a plant would not be needed to a great extent, were methods and habits of cultivation perfect or in a high state of development; but this phase of the economic aspect of the case must at present be insisted on.

Finally it may be said that as a fertilizer this Steel-weed takes a high rank. It is regarded by observant farmers as but slightly inferior to a crop of clover. It does not decompose when turned under as quickly as clover, but that it yields plant-food and answers well the mechanical purposes of a coarse fertilizer, testimony is unanimous and apparently conclusive.

Explanation of Plate 3.—*Aster ericoides pilosus*, reproduced from photographs taken late in November Figures 1 and 2 show plants with abundant, and Figure 3, with few young shoots close to the ground Plants shown in Figures 1 and 2 had the tops removed in summer, Figure 3 shows the common appearance at the end of the growing season of undisturbed plants

GEOPHILOUS PLANTS OF OHIO.

F. J. Tyler.

Geophilous—meaning earth loving—is a term which has recently been applied to such plants as have some special adaption, which enables them to withdraw beneath the surface of the ground when adverse conditions, such as extreme heat and drouth, cold, etc., overtake them. Such adaptions may be classified as

Rhizomes,
Bulbs,
Corms,
Crowns.

Rhizomes are underground stems and like other stems may be simple or branched. The branched rhizome is, however, the most common form since it combines vegetative reproduction with the other advantages of a rhizome habit. The Brake Fern (Pteris aquilina L) is an example of a much branched rhizome and Solomon's Seal (Polygonatum biflorum Ell.) of a nearly simple rhizome.

The stem of a rhizomatous plant may remain permanently underground, as is the case with all ferns except the tree ferns of the tropics. An annual stem is, however, usually sent to the surface and this may be a lateral branch from the main subterranean stem or it may be a continuation of the rhizome, in which case the next year's rhizome will be a lateral branch and thus the whole rhizome will be made up of a number of distinct segments. Various members of the Iris group are good examples of this. In at least one genus of Ohio plants—Smilax—there are some members having both a perennial woody stem and a well developed rhizome. It may be that these plants are leaving the rhizome habit and are taking up the woody stem habit.

Perhaps in most cases rhizome plants became such through the gradual covering of trailing stems. It is a protection and a saving of building material to a plant if its stems are trailing or creeping, still more so if they are covered by leaf mould or soil. If rhizome plants were once trailers there should be every gradation between the two and so we find. The Trailing Wahoo is a good example of this, since some of its stems are often covered by leaf mould or soil while others are on the surface or some inches above. Many of the Ericaceæ are in this transition stage between trailers and geophytes. The Wintergreen (Gaultheria procumbens L.) has a long, creeping stem which is often or usually covered by leaf mould. It roots freely and sends up perennial woody branches to the surface. It is hard to say in such cases whether the plant is geophilous or not.

Many geophilous plants of the rhizome type were doubtless once crown formers and here again we find a transition stage which contains every gradation between the two groups. The Compositæ are mostly crown formers, but some are true rhizome plants and some are transitional.

The advantages of a rhizome habit are very apparent. The first and most important advantage is the protection from frost which this habit affords. By taking up this habit many plants have been able to withstand a climate, which would otherwise prove fatal. The Alpine Willow is an example. Rhizomes are often storehouses for food and become swollen and distorted in consequence. Vegetative propagation is usually combined with the geophilous habit and with great advantage to the plant In most cases a rhizome dies off at the back as fast as it grows in front so that any part of it lives a definite number of years. The individual segments of the Solomon's Seal, for instance, live from three to five years. In this way a branch soon becomes a separate plant In some cases, however, the rhizome may live for many years and thus hundreds of seemingly independent plants may be connected beneath the surface of the ground. The Brake Fern (Pteris aquilina L) is of this class and an entire hillside may be covered with a much branched specimen of this plant.

A plant which has no means of migration when it has exhausted the nearby food supply is manifestly at a disadvantage when compared with a progressive rhizome plant which moves every year into a new and fresh location. To be sure, the distance it travels may not be far but it is enough to remove the plant from an exhausted position and from its wornout and useless tissue. Thus this group of plants may be said to have found the secret of potential immortality, for, unless some catastrophe overtakes them, they may live indefinitely and remain young. It is interesting in this connection, to note how far some of these plants travel in a century. This may be calculated in a general way by measuring the annual growth in length of the rhizome. Solomon's Seal travels from twelve to twenty feet in this length of time, Uvularia perfoliata L. from eight to ten feet, Onoclea sensibilis L. from three hundred to five hundred feet, and others still farther.

The Iris group are exceptions, in that they travel in a circle. The reason seems to be that the lateral branches which continue the rhizome from year to year mostly arise on the same side of the terminal bud, so that each branch goes off at a slight angle to the former branch. The degree of angle determines the size of the resulting circle. One class of rhizome plants is very distinct and requires especial mention. This class may be termed upright or retrogressive rhizome plants. The upright rhizome may originate from a progressive rhizome, or from a crown former or in some other way. Trillium nivale Riddell is in a transitional stage between the progressive and retrogressive classes, since the large rhizomes are upright and the young lateral branches are progressive until they have traveled some distance away from the parent rhizome, when they too, become upright. The lower Ferns (Ophioglossaceæ) belong to this class. The disadvantage of this habit is that the rhizome will soon grow out of the ground and be in a very exposed condition. To counteract this tendency the roots of these plants are usually strongly contractile and pull the rhizome down into the ground as fast as it grows out. Skunk Cabbage (Spathyema foetida (L.) Raf.) has an upright rhizome and root contraction is very marked. The very apparent disadvantages of the retrogressive or upright rhizome habit have made this class very few in number compared with the progressive rhizome class. In Ohio there are about 475 species of rhizome plants and less than twenty-five of these belong to the retrogressive class. This class is closely related to the corm plants, indeed, all that is needed to make the typical corm out of a retrogressive rhizome plant, such as Trillium nivale, is to shorten and make more definite the annual growth of the rhizome. The bulb is usually a very short, upright rhizome with many thickened scales. The bulb of Lilium martagon is of this kind but that of Lilium canadense is more closely related to the progressive rhizomes. The parent bulb sends out one or more thick rhizomes which grow outward if the bulb is at the normal depth, downward if the bulb is too near the surface of the ground and the new bulbs are formed by the shortening of the outer end and the growth and thickening of the scales of the rhizome.

Both bulbs and corms may be regarded as rhizomes modified to suit peculiar conditions, such as a long, dry, heated period alternating with a short, rainy period. A plant to survive under such conditions must be able to start up very quickly as soon as the rains come, and flower and mature its seeds before the drouth again overtakes it. A large amount of food material must be stored up by the plant in order to do this, and the food material must be kept from drying or burning up during the heated period. Bulbs and corms, protected as they usually are by dry and coriaceous coverings, answer these requirements and are usually abundant in localities where these conditions obtain. Bulb and corm plants are also well fitted to live in dense woods where the light is soon shut off in the Spring by the expanding leaves of the trees. They are able to spring up very early, flower and ripen seeds before the light is shut off. The food supply which enables them to do this is often protected by acrid or poisonous principals developed in the bulb or corm. Pepper-root (Dentaria laciniata Muhl.) and Jack-in-the-Pulpit (Arisaema triphyllum [L.] Torr.) are examples.

Crown plants, while not true geophytes, are often closely related to rhizome plants and may be regarded as transitional. They are formed by the freezing back of the upright stem to the surface of the ground, and the survival of the short stem beneath the surface until the next Spring when it sends out branches from adventitious buds. In this way several branches are sent up where there was one before, and, as this crowds and injures the plant, these branches usually move out some distance from the base of the parent plant before coming to the surface. The connection with the main stem is often severed, and thus many new plants are formed All this rarely takes place in the Spring but has been shifted back to late Summer or Fall by the parent plant. Often a food supply is stored up for the young plants by the parent Helianthus tuberosus L. is a good example.

Vegetative propagation is brought to its highest development in this class and they become our worst weeds.

NOTES ECONOMIC AND TAXONOMIC ON THE SAW BRIER, SMILAX GLAUCA.

W. A. Kellerman.

(Plate 4)

In a recent trip through some of the southern counties of the State my attention was arrested by the enormous quantity of Smilax glauca—Glaucous-leaf Brier as given by Britton in the Illustrated Flora—but generally and appropriately called in these regions where so abundant, the Saw Brier. In the sandy soil of Hocking County, thence southward to the Ohio River this plant may be seen growing in field and pasture, by roadside and on hillside, and everywhere except in wet soils and dense woods. It climbs over fences and high bushes, displaying its bright foliage of lively green, more effective by contrast with the abundant white bloom on the under side. In the Autumn it presents showy wreaths of black but glaucous-coated berries and the most gorgeous coloration of foliage. The leaves remain for the most part late in Fall and Winter, and for brilliant and delicate shades of rose and red are not surpassed by any plant of our entire flora. The forbidding aspect of the long, wiry stems, with their bristly covering of long, saw-like or needle-shaped prickles, serves also to distinguish this plant even among the attractive associates of its kingdom.

A Bad Weed.—As a weed this species here stands at the head of the list. Its horrid prickles make it one of the most disagreeable plants with which to come in contact. It revels in the pastures and clambers over the fences; it flourishes in the meadows and fields, and no ordinary practice of crop-cultivation interferes with its luxuriance. One can readily see that it is not carelessness on the part of the farmer that suffers half or still larger portions of his fields to be covered with this pestiferous vine. No other weed is seen in the area and therefore he has been diligent and careful in his tillage. The meadows even if twice or thrice mowed in a season will yet contain year to year the same quantity of Saw Brier. The stems spring up quickly, and grow "a foot in a night" the people say; surely the Saw Brier is the freshest plant in the field. In a case specially noticed a garden spot had been put in cultivation in 1878, and has been continually and thoroughly cultivated every year since, yet the Saw Brier is there to-day

THE UNDERGROUND PARTS.—This tenacity of life and luxuriance of growth can be understood when the underground parts are examined. There are numerous irregular and often large tubers or enlargements which serve as the capacious storehouse of nourishment. They are often of fantastic shape. Various forms are shown in figure 1, plate 4. These occur at irregular intervals on the long and tortuous subterranean stems. It is said that they may be found several feet below the surface, though the eight specimens shown on the plate were found at a depth of six to twelve inches. If they all could be removed from the soil the weed would of course be practically annihilated. But when found at a depth of several feet—as seen sometimes in making excavations for foundations, walls, etc.—it is evident that the farmer will have to make extraordinary and long-continued efforts to destroy this pest. The less courageous may well be appalled in contemplating the herculean task Fortunately swine are fond of the nutritious tubers, and voraciously devour them when they are given the freedom of the field and allowed to indulge in their natural propensities. Heavy coating of manure and winter plowing are also indicated.

VARIATIONS IN THE LEAVES.—This form is easily recognized among the several species of Smilax indigenous to Ohio, though the leaves vary in size and shape to a remarkable degree. A large number of the common forms are shown in figure 2, plate 4. They are sometimes very broadly cordate-oval, wider than long; often ovate-cordate, oval or ovate, lance-oval, oblong to oblong-ovate, broadly to narrowly lanceolate and even linear; they are mostly cuspidate at the apex, in some cases tapering to acute or sub-acuminate. The base is mostly cordate and subcordate, but occasionally tapering. It is seldom that forms approaching halberd-shape occur in our region. An inspection of plate 4 will illustrate these several forms. The twig with fruit marked 6, bears a very common form of the leaf as does also the one marked 1. The broad-leaf form is not uncommon, but the very broad-leaf as seen in specimens marked 8 and 5 is of much less frequent occurrence. The very narrow leaves are as a rule borne on short stems—such as have developed in fields and meadows where the earlier stems have been destroyed or disturbed. But often on such stems (marked 1) the leaves are broad and have the natural shape.

Size of Leaves.—The size of the leaves is strikingly variable. The specimens shown on plate 4 being reproduced from photographs exhibit correctly this variability. Careful measurements also were made of leaves taken at random from hundreds selected to illustrate this point. These since they give both the length and width of the leaf demonstrate the shape as well as the size. The measurements are in decimeters and one hundred of them are as follows·

12x11 5
11x10.5
12x11
18x10.6
11x12
12 5x11,2
12.2x10
12x11
11x11
11.5x11.1
11x10.8
12x11.5
12x10 6
18x11
12x11
11.5x10.8
12x11 8
12.5x9 5
12x9.5
12x11
11x11 8
12.2x9 8
11.5x10
18 5x10.5
11 5x9 6
8x5.5
9x6
9.2x6.5
8x5.5
9x7
8.5x7 5
7.5x4.5
8.5x6.2
9x7
8.5x6
7.5x5 5
8.6x5.4
8x6
9x6
8 5x6
8.5x5.8
9.8x6.4
9x7.3
8.3x5.8
9x6 5
9 9x7 6
8 2x4.6
8 5x6
8.8x6
9.5x7
11.1x2.2
9x2
9x3.5
8x1 5
6x0.7
8x1.5
7x1.8
6.8x2
7.5x2 2
5.5x2 5
7.0x2.2
7.8x2
6 5x2
7x0.8
8.4x0 7
8x1.4
8 5x2
9x8.5
9.5x8.8
8x4
7x2.8
8x8.8
4.5x1
7x2.2
7x8 2
6.2x2 5
8.2x2.8
6.5x2 2
5.5x2.9
7.8x2.7
8x1 8
9.5x1 9
9.5x2.2
8.4x2.2
8x2.5
7.8x2.2
7.3x2.8
6x1.7
5.8x1.6
8x8.4
7.5x2.5
6x2.5
6x2 8
6x2.6
7x2.8
8.4x8
9 8x8.5
10x8.5
9.6x8.8
7.5x1.7
9.4x2.5

Description of the Leaf.—Neither the description as given originally (1787) by Walter nor those contained in our Manuals give any intimation of such variability as actually occurs. Some of them are as follows: Walter says "foliis oblongo-cordatis"; Wood, "ovate, finally nearly orbicular, abruptly contracted at one end"; Gray, "ovate, rarely subcordate, abruptly mucronate"; Britton, "ovate, acute or cuspidate at the apex, sometimes cordate at the base." I would suggest the following as applicable to the Ohio specimens: Leaves *mostly ovate, often broadly oval (occasionally broader than long), sometimes oblong-ovate, varying to lanceolate or even linear; the base mostly sub-cordate but often cordate or even cuneate; the apex cuspidate to acute or sub-acuminate.*

Smilax spinulosa.—Britton and Brown in the Illustrated Flora, 1: 440, appends to the description of Smilax glauca the following paragraph: "Smilax spinulosa J. E. Smith, is a form with numerous small prickles on the lower part of the stem, and more elongated, sometimes halberd-shaped leaves. It occurs in southern New York, but is not well understood" However Smilax spinulosa

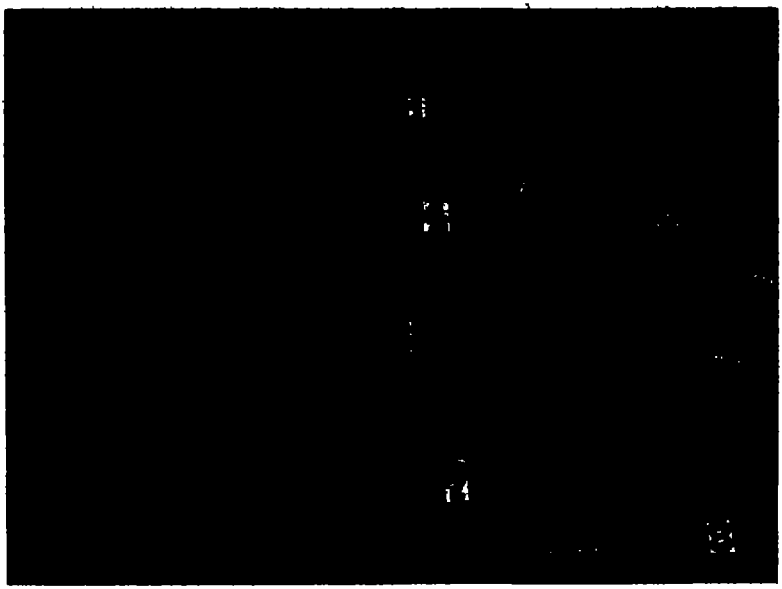


Fig. 1

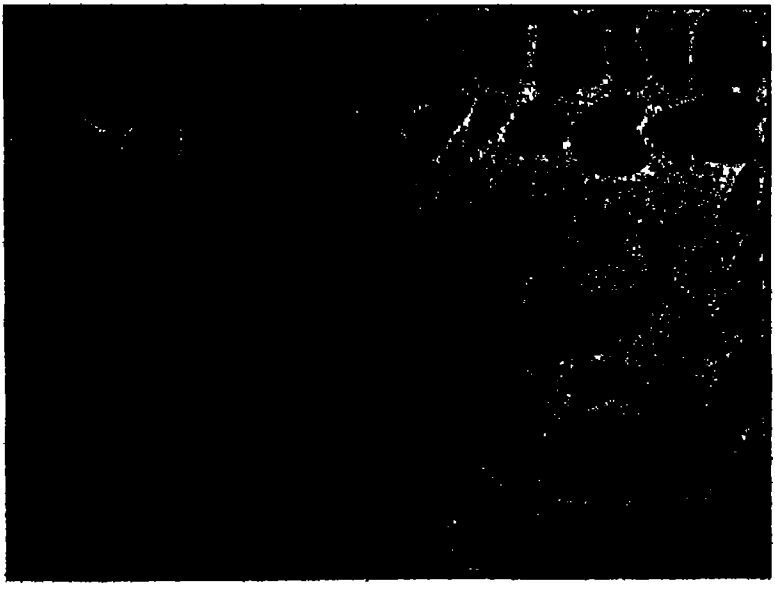


Fig. 2.

KELLERMAN ON SMILAX

is given by these authors as a synonym of Smilax glauca, which according to my judgment is correct

SMILAX SPINULOSA AN EXTREME FORM OF S. GLAUCA.—The material secured recently fortunately clears up the case unless I misapprehend the purport of the above quotation. The "more elongated leaves" spoken of may find their counterpart in the figures on plate 4, and yet there can be no question that they belong to Smilax glauca. The twigs bearing them were in many cases found *attached to the same underground stems* that bore the broad leaves. Even at a glance the identity of the specimens in the field could not be mistaken, all their characters showed that they were really Smilax glauca. In herbarium specimens that have been preserved every gradation may be seen between the extremes shown in the plate. These specimens also show in some cases underground stems that bear both leaves and twigs with leaves of the broader form As a rule in the cornfields where the soil is not rich and crop-cultivation has been diligent the narrower leaves (on shorter stems) are common. In richer cornfields, and in meadows, especially if quite fertile, the short stems are clothed with the broader leaves. Abundant evidence was at hand to demonstrate that this form with "more elongated leaves" (S.spinulosa) is directly connected with the form called S. glauca by the taxonomists. Its peculiarities are doubtless referable to the special environment; in no case could these apparently aberrant specimens be called a specific or even varietal form.

EXPLANATION OF PLATE 4 —Smilax glauca Figure 1 Eight specimens of tubers reproduced from photographs and much reduced Fig 2 Twigs (1-6) bearing leaves of varying shapes also separate leaves (7-56) illustrating variation in shape and size

MEETINGS OF THE BIOLOGICAL CLUB.

OCTOBER 1ST, 1900, BOTANICAL HALL.

This evening was spent in the giving of reports on work done during the summer vacation. Osborn, Mills, Griggs, Tyler, Miss Dufour, Schaffner and Hine gave reports. Seven names were proposed for membership.

The motion by Professor Osborn to hold the meetings of the current year in Biological Hall was carried.

Hine, Morse and Miss Dufour were appointed a nominating committee to select officers for the year

NOVEMBER 5TH, 1900.

Members assembled in Biological Hall. President Schaffner called the meeting to order. Officers were elected as follows: Osborn president, Tyler vice-president, Hine secretary.

Long, Wyman, Ball, Hambleton and Dunlap were elected to membership.

The retiring president, Professor Schaffner, gave the address of the evening. He had for his subject "The Life History and Cytology of Erythronium."

Landacre and others took part in a discussion of the paper.

J. S H.

NEWS AND NOTES.

The tenth annual meeting of the Ohio State Academy of Science will be held at the Ohio State University, Columbus, on December 26 and 27, 1900.

PETIOLES OF THE COTTONWOOD.—The leaves of the Cottonwood as well as some other species of Populus have an interesting light relation. If one looks at a vigorous shoot, the leaves are seen to be arranged in the profile position around the stem. This is accomplished by means of a very simple device. The petiole is much flattened next to the blade and is quite flexible The flattening is transverse to the plane of the blade and on this account the leaf will assume the vertical position, no difference in what way it is attached or twisted. This adaptation is also responsible for the musical rustle one hears when resting in the shade of the Cottonwood The leaves are very smooth and nearly alike on both sides. Because of these and other adaptations, the Cottonwood is one of the most successful of our semi-xerophytic trees and one of the last stragglers to be found in the western part of the great plains. J. H. S.

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NOTES ON THE SELF-PRUNING OF TREES.

JOHN H. SCHAFFNER AND FRED J. TYLER.

In a dense forest of growing trees the smaller, side branches of the main stem, as well as those of the larger branches, are continually dying off. But the tree rids itself of these dead branches by forming a collar of tissue from the cambium layer around the base of the branch, which presses more tightly as layer after layer of living wood is added, until the branch finally falls off and the hole which is left is grown over in a short time. This process is known as natural pruning But the process which we wish to consider is very different from this, and we desire to distinguish it by the term, self-pruning. In this case the living branches are cut off or else the cutting-off process is the cause of the death of the branch. A special adaptation is provided to accomplish the result and the process is one whose purpose is the shedding of the branches rather than the attempt to accommodate the plant to conditions of injury brought about by other causes. In a number of species perfectly formed winter buds were developed on the branches which were shed, and so far as our observations go, the twigs are cast in the fall and winter.

Although the shedding of branches is well known, especially in the conifers, not as much notice has been taken of it as we think it deserves. We have been taking observations for several years and have been partly anticipated by Dr. Bessey in a note in *Science* 12. 650, 1900, — Botanical Notes — The Annual Shedding of Cottonwood Twigs Bessey describes the shedding of the twigs of Populus deltoides as occurring about the middle of October, and after giving the details of the process, concludes as follows: "It is an interesting fact that the Tamarisks (Tamarix sp.) which are held by some botanists to be closely related to the Poplars, shed their twigs by exactly the same device as that described above. In the Tamarisks the shedding of the twigs is a part of the annual process of defoliation, their leaves being so small that it appears to be less trouble and expense to drop twig and all than to separate every individual leaf. Possibly in the Cottonwoods, with their large leaves, we have a survival of the Tamarisk twig-shedding habit long after its original significance has disappeared." Dr. Bessey, however, we believe, will not insist on this supposition when he considers that the same thing occurs in species of *Prunus*, *Quercus*, and other widely separated genera.

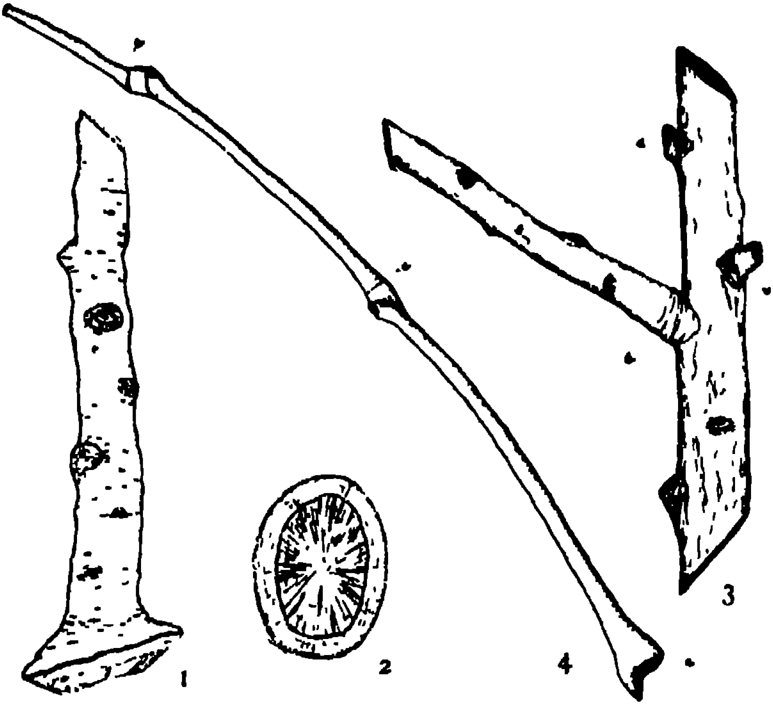

FIG. 1.—Twig of *Populus alba*, showing large basal joint and scars where smaller twigs have been detached.

FIG. 2.—View of basal joint of same twig as Fig. 1.

FIG. 3.—Twig of *Salix nigra*, showing position of the brittle zone (*a*).

FIG. 4.—Green twig of *Ampelopsis cordata*, showing joints (*a*) at the leaf nodes.

The self-pruning of twigs from woody stems, so far as our observations go at present, is accomplished in three general ways: 1st, by the formation of a single joint close to the parent branch; 2nd, by the formation of a brittle zone near the base of the limbs which are to be shed; 3rd, by a series of transverse joints corresponding to the leaf nodes.

Among the plants which come in the first class, the most striking perhaps, is Populus alba, in which very large branches are frequently cut off in such a perfect manner that one might think the pruning had been done with a sharp knife. Green twigs from one to fifteen years old were found to be shed and no doubt still older ones are cut off. The twigs have well-developed winter buds and this is also the case in other species of Populus and in certain species of Quercus and Prunus In Quercus alba shed twigs were found from one to four years old while in Q. acuminata there were some seven years of age. In Prunus serotina twigs from one to six years old were cut off. In Ulmus Americana not only are joints formed at the base of the twigs, but the twigs also break apart at the nodes, caused by annual growth

The following species were found belonging to the first class:

Populus alba L
" deltoides Marsh
" grandidentata Mx.
" tremuloides Mx
" dilatata Ait.
Quercus alba L.
" robur L
" macrocarpa Mx
" acuminata (Mx.) Sarg.
Ulmus americana, L.
Prunus serotina, Ehrh
Tamarix gallica L.
Tsuga canadensis (L.) Carr.

All the plants found with brittle zones belonged to the willows. It is interesting to note that the branches shed may be one to several years of age and that certain branches do not develop a brittle zone Salix nigra and S. amygdaloides seem to show the character most perfectly and it is remarkable to see how readily the branches drop off.

The following species show the adaptation·

Salix nigra Marsh.
" amygdaloides anders
" fragilis L.
" alba vitellina (L) Koch.
" babylonica L.

Among those which come in the third class, the most remarkable plant observed was Ampelopsis cordata. About the time that the leaves are shed nearly all the slender green branches literally fall to pieces and drop off. Most of the fruit is on these branches and the berries are thus shed at the same time. In the winter the plant is remarkable for the few branches left and it looks like an artificially pruned vine.

The species observed belonging to this class are the following:

Ampelopsis cordata Mx.
" tricuspidata Seib. & Zucc
Parthenocissus quinquefolia (L.) Planch.

The shedding of the twigs of woody plants may in many cases be entirely an adaptation to get rid of the leaves as in the case of the dwarf branches of Pines and the young twigs of Tamarisks. But even in the Tamarisks it is doubtful whether the joints formed in the older branches can be claimed to have such a purpose, since in this case the leaves have all been shed with the annual twigs. The shedding of the old woody branches may have a different purpose. In regard to the trees mentioned above, we think that the process is one primarily to rid the tree of surplus branches. This would manifestly be an advantage and would give room and opportunity for the development of many young leafy shoots every year without accumulating too great a mass of useless members This is certainly the case with the poplars and the willows. In no case do we think it admissible to say that the adaptation is primarily for the purpose of propagation, although this may be a very important incidental result in such plants as the willows when growing in wet places. In the case of Ampelopsis cordata, the only reasonable explanation seems to be a preparation for the winter condition, since the branches which are shed do not ripen and the plant has an admirable method for shedding its leaves The slender branches would be in great danger of being killed by the cold of winter. The shedding of the young branches of Taxodium distichum (L.) Rich. is remarkably like that in Tamarix. The slender, dwarf branches clothed with the leaves drop off in the fall or the following spring. The habit must be quite ancient, as such branches of Taxodium distichum miocenum Hr are very abundantly preserved as fossils. In Taxodium mexicanum Carr. the dwarf branches are not shed until the second year Glyptostrobus pendulus Endl and G. heterophyllus Endl also have deciduous dwarf branches. There are other conifers and no doubt many other angiospermous trees which possess these interesting adaptations and by careful observations, no doubt many interesting ecological facts will be brought to light.

PLANT NAMES COMMEMORATIVE OF OHIO BOTANISTS.

CLARA ARMSTRONG.

Though Ohio has had fewer botanists than many other States, some of these became known wherever botany was cultivated. Riddell was one of the pioneer botanists of the west and for six years he was a resident of this State. By the publication of his *Synopsis* he contributed largely to Ohio Botany. The names of Sullivant and Lesquereux shed still greater luster on our state. Most of the work of the former and all of that of the latter was done in Ohio. Several others whose names are given below have been industrious students of our Flora, and have spent many years if not all their lives within our territory It is a long and interesting list of botanical names which commemorates their scientific labors. In the preparation of this paper I have been aided materially by Prof. W. A. Kellerman.

JOHN LEONARD RIDDELL.—Born in Leyden, Mass., Feb 20th, 1807; died in New Orleans, La., Oct 7, 1865. He graduated from Rensseler Institute, Troy, N. Y. He came to Ohio in 1830 and became professor of Botany and adjunct Professor of Chemistry in the Medical College of Cincinnati. He was an enthusiastic and industrious botanist, and collected extensively in many parts of our State. Scarcely any of his specimens seem now to be in existance though he prepared sets for sale and accumulated a large herbarium. His most important publication was the Synopsis of the Flora of the Western States. He also published a Supplementary Catalogue of Ohio Plants. In 1836 he left Ohio, carrying his botanical specimens to New Orleans where he became professor in a Medical College; he was also in the employ of the government until his death. He furnished many notes and longer articles to scientific journals and was the author of many new species of plants. The following have been named in his honor:

Riddellia, synonym of Psilostrophe, a genus of the Compositae family.

Solidago Riddellii, a species of Golden Rod.

Senecio Riddellii, synonym of S. Douglasii, a species of Compositae.

WILLIAM STARLING SULLIVANT.—Born in Franklinton, Ohio, Jan. 15, 1803, died in Columbus, Ohio, April 30, 1873. He was educated at Ohio University and Yale. The death of his father at the time of his graduation prevented him from studying for one of the learned professions and he became a surveyor and practical engineer, which occupation he followed until late in life. During this time he collected and studied the plants of central Ohio, and in 1840 he began to pay particular attention to Mosses; this became the subject of his special study, and he was soon recognized as the most eminent bryologist that this country has ever produced.

In 1864 the degree of LL.D. was conferred on Sullivant by Gambier College. He was elected to membership in many scientific societies both in the United States and Europe. At his death his bryological books, collections and preparations of Mosses were given to the Gray Herbarium of Harvard University. The remainder of his botanical library was bequeathed to the Ohio State University then called the Agricultural and Mechanical College His microscopes were given to Starling Medical College Of this institution he was senior trustee. He was the author of many new species and the plants named for him by other botanists are as follows

Sullivantia, a genus of the Saxifrages The name first proposed by Gray (1840) for the species discovered by Sullivant was Saxifraga Sullivantii, two years later Gray established the genus Sullivantia and published the name of the plant in question as Sullivantia Ohionis According to the rules of priority that name now stands as Sullivantia Sullivantii.

Discina Sullivantii, a species of discomycetous fungi
Panus Sullivantii, a species of Agaricineae.
Lentinus Sullivantii, a species of Agaricineae.
Marasmius Sullivantii, a species of Agaricineae
Psilocybe Sullivantii, a species of Agaricineae.
Boletus Sullivantii, a species of the Polyporeae.
Polystictus Sullivantii, a species of the Polyporeae
Thelephora Sullivantii, a species of the Thelephoreae.
Cephalozia Sullivantii, a species of Liverwort
Jubula Sullivantii, a species of Liverwort.
Kantia Sullivantii, a species of Liverwort
Porella Sullivantii, a species of Liverwort
Hypnum Sullivantii, a species of Moss.
Astomum Sullivantii, a species of Moss.
Amphoridium Sullivantii, a species of Moss.
Brachythecium Sullivantii, a species of Moss.
Bruchia Sullivantii, a species of Moss.
Cylindrothecium Sullivantii, a species of Moss.
Fontinalis Sullivantii, a species of Moss.
Macromitrium Sullivantii, a species of Moss.
Neckera Sullivantii, a species of Moss
Phascum Sullivantii, a species of Moss.
Pleuridium Sullivantii, a species of Moss.
Schlotheimia Sullivantii, a species of Moss
Eurhynchium Sullivantii, a species of Moss.
Hookeria Sullivantii, a species of Moss.

Zygodon Sullivantii, a species of Moss.
Sphagnum Sullivantianum, a species of Moss.
Asclepias Sullivantii, a species of Milkweed.
Lonicera Sullivantii, a species of Honeysuckle.
Carex Sullivantii, a species of Sedge
Callipteridium Sullivantii, a fossil plant.

There were also two species of Mosses named for Mrs. Sullivant as follows:

Hypnum Sullivantiae, a pleurocarpous Moss
Plagiothecium Sullivantiae, a pleurocarpous Moss.

LEO LESQUEREUX —Born in Fleurier, Switzerland, Nov. 18, 1806, died in Columbus, Ohio, Oct 25, 1889 On entering the Academy of Neuchatel he met Arnold Guyot and together they became devoted to natural science In 1822 he went to Eisenach preparatory to entering the University of Berlin, supporting himself by teaching French. He was principal of a college at Chaux de Fonds but had to give this up on account of deafness. From this time he did engraving, made watch springs, and studied Mosses and fossil plants.

In 1848 Lesquereux came to America settling at Cambridge, where he assisted Louis Agassiz, but he soon removed to Columbus, Ohio, where he lived until his death. He was a worthy associate of William S. Sullivant to whom in fact he was indebted by the most commendable generosity. He was a paleo-botanist and a student of Mosses Many plants are named for him including a large number of fossil forms

Lesquerella, a genus of Cruciferae
Lesquereuxia, synonym of Siphonostegia, a genus of Scrophulariaceae.
Hysterographium Lesquereuxii, a species of Pyrenomycetous Fungi.
Webera Lescuriana, a species of Moss.
Bryum Lescurianum, a species of Moss.
Archidium Lescurii, a species of Moss
Atrichum Lescurii, a species of Moss
Fontinalis Lescurii, a species of Moss.
Hypnum Lescurii, a species of Moss.
Orthotrichum Lescurii, a species of Moss.
Sphagnum Lescurii, a species of Moss.
Thelia Lescurii, a species of Moss.
Alyssum Lescurii, a species of the Mustard Family.
Lepidophoroxs Lesquereuxii, a fossil plant.
Lepidodendrum Lesquereuxii, synonym of L. clypeatum, a fossil plant.

Sphenopteris Lesquereuxii, a fossil plant.
Sphaerites Lesquereuxii, a fossil plant.
Persoonia Lesquereuxii, a fossil plant.
Buthotrephis Lesquereuxii, a fossil plant.
Pecopteris Lesquereuxii, a fossil plant.
Cardiocarpon Lescurianum, a fossil plant.
Triphyllopteris Lescuri, a fossil plant.
Odontopteris Lescurii, a fossil plant.
Sigillaria Lescurii, a fossil plant.
Sphenopteris Lescuriana, a fossil plant.
Taeniopteris Lescuriana, a fossil plant.
Triphyllopteris Lescuriana, a fossil plant.
Rhabdocarpus Lescurianus, a fossil plant.
Thinfeldia Lesquereuxiana, a fossil plant.
Laurinoxylon Lesquereuxiana, a fossil plant

JOHN STRONG NEWBERRY.—Born at Windsor, Conn., Dec. 22, 1822, died in New York, Dec 7, 1892. He graduated from Western Reserve College 1846 and from Cleveland Medical College 1848. He studied abroad for two years and then practiced medicine in Cleveland until 1855 when he was appointed acting Surgeon and Geologist to an exploring expedition through the country between San Francisco and the Columbia River. He went on several of these expeditions studying the botanical zoological, and geological features of the country. In 1869 he was appointed Chief Geologist to the Geological Survey of Ohio

In 1859 Newberry published the first State Catalogue of Ohio Plants. About 1865 he was made professor of Geology and palaeontology at Columbia College School of Mines which position he held until his death. His chief botanical work was in palaeo-botany though quite a number of living plants as well as many fossil species commemorate his name.

Newberrya, a genus of the Indian Pipe Family.
Gentiana Newberryi, a species of Gentian
Abutilon Newberryi, a species of Malvaceae.
Leptosyne Newberryi, a species of Compositae.
Pentstemon Newberryi, synonym of P menziesii, a species of Scrophulariaceae.
Potentilla Newberryi, synonyn of Ivesia gracillis, a species of Rosaceae.
Ferula Newberryi. synonym of Peucedanum Newberryi, a species Umbelliferae.
Astagolyous (Oxytropis) Newberryi, a species of the Leguminous Family.
Notholaena Newberryi, a species of Fern.
Physaria Newberryi, a species of Fern.

Coloptera Newberryi, a species of Fern.
Leucampyx Newberryi, a species of Fern.
Cardiocarpon Newberryi, a fossil plant.
Dadoxylon Newberryi, a fossil plant.
Odontopteris Newberryi, a fossil plant.
Cordaites Newberryi, a fossil plant.
Pseudopecopteris Newberryi, a fossil plant, synonym of Sphenopteris Newberryi.
Dictyophylon Newberryi, a fossil plant.
Cardiocarpus Newberryi, a fossil plant.
Archaeopholon Newberryanum, a fossil plant.
Viburnum Newberryanum, a fossil plant.
Celastrophyllum Newberryanum, a fossil plant.
Pecopteris Newberryana, a fossil plant
Taeniopteris Newberryana, a fossil plant
Platanus Newberryana, a fossil plant.
Laurus Newberryana, a fossil plant.
Myrica Newberryana, a fossil plant.
Salix Newberryana, a fossil plant.

H. C. Beardslee.—Born in Connecticut. Died December, 1884, in Painesville, O He came to Ohio and became a practicing physician at Painesville. He published the second State Catalogue of Ohio Plants in 1874. This was a pamphlet of nineteen pages; it was reprinted in the State Agricultural reports of 1877. After his death Dr. Beardslee's herbarium of about 4000 species, especially rich in Carices, Grasses, and Salices, was given to Oberlin College The following species was named in his honor·

Chantransia violacea Beardslei, a species of fresh-water Alga.

Andrew Price Morgan.—Born at Centerville near Dayton, Oct. 27, 1836, now living in Hamilton County. He has done much toward the development of Mycology in this country. He has made known a large number of higher fungi of the south-eastern part of Ohio. He is the author of many new species. A number of plants belonging to the group of Fungi have been named in his honor, as follows:

Boletus Morgani, a species of Polyporeae.
Polyporus Morgani, a species of Polyporeae.
Lepiota Morgani, a species of Leucosporeae
Russela Morgani, a species of Leucosporeae.
Cantharellus Morgani, a species of Leucosporeae.
Hypoxylon Morgani, a species of Pyrenomycetaceae.

There is also one species of Agaricineae named for Mrs. Morgan:
Hygrophorus Laurae, a species of Fungus.

WILLIAM ASHBROOK KELLERMAN—Born at Ashville, Ohio May 1, 1850 He was educated at Cornell and the German Universities, receiving the degree of Ph D. in 1881.

For a time he was teacher of natural science in the Wisconsin State Normal School, later was professor of Botany and Zoology at the Kansas Agricultural College, State Botanist of Kansas, and Botanist of the Kansas Experiment Station He was the founder and editor (for four years) of the Journal of Mycology He has held the position of Professor of Botany in the Ohio State University since 1890 and is the author of a number of text-books and articles for botanical journals He has accumulated a very large and valuable private Herbarium of parasitic fungi, and a State Herbarium of the Flora of Ohio for the Ohio State University that already numbers many thousands of mounted sheets. The names given by botanists complimentary to his work are as follows:

Kellermannia, a genus of Sphaeropsideous fungi.
Aecidium Kellermannii, a species of Uredineae
Plasmopora Kellermannii, a species of Phycomycetous Fungi.
Rosellinia Kellermannii, a species of Sphaeriaceous Fungi.
Rhabdospora Kellermannii, a species of Sphaeropsideous Fungi.
Diaporthe Kellermanniana, a species of Pyrenomycetous Fungi.
Physcomitrium Kellermani, a species of acrocarpous Moss.

MISS H F. BIDDLECOME.—Of Columbus, formerly of Springfield, assiduously collected and studied the flora of Greene and Champaign counties, Ohio. She discovered a species of Moss and one of Liverwort which have been named in her honor.

Bryum Biddlecomiae, a pleurocarpous Moss.
Trichocolea Biddlecomiae, a species of Hepaticae, or Liverwort.

F. D. KELSEY.—Born at New Washington, Ind, Feb. 15, 1849, but early moved to southern Ohio where he lived until 1856, when he moved to Columbus He was graduated from Marietta College in 1870 The next year he went to Andover Theological Seminary where he graduated in 1874. He served Congregational Churches until 1885 when he moved to Helena, Montana. Here he made collections and distributed the local flora. The College of Montana conferred on him the degree of Sc D.

In 1892 he was elected Professor of Botany at Oberlin College, which position he held until 1897, when he accepted the pastorate of the Central Congregational Church in Toledo, which he now holds. He is also lecturer on Botany at the Smead School for Girls at Toledo, Ohio. While professor at Oberlin he published several bulletins of local interest, and one monograph of Uncinula, with microscopic drawings of all American species. There are several species named in his honor, as follows:

Kelseya, a monotypic genus of Rosaceae.
Cucurbitaria Kelseyi, a species of Pyrenomycetous fungi.
Homostegia Kelseyi, a species of Pyrenomycetous fungi.
Cryptanthe Kelseyi, a species of Boraginaceae.
Phlox Kelseyi, a species of Polemoniaceae.

THE MAXIMUM HEIGHT OF PLANTS. II.

JOHN H. SCHAFFNER.

Last spring the writer published a few measurements of some common western plants in the Asa Gray Bulletin (Vol. 8 · 19-20). A few other measurements are given below, all from Kansas except four which are from Ohio. It would be well for all collectors to keep records of the size of the plants which they meet, including measurements of the height and also dimensions of the leaves, flowers, fruits and underground parts. In this way the manual of the future may be brought to represent more accurately the living plant as it grows in nature rather than the dried, shrunken and dwarf specimens of the herbarium

	Gray	Britton	Measured Feet
Agropyrum repens (L.) Beauv		4	4¾
Asparagus officinalis L.		7	8¾
Polygonum orientale L. (Ohio)		8	9
Allionia nyctaginea Michx. (Oxybaphus nyctagineus Sw.)	3	3	5
Silene antirrhina L.	2½	2½	3
Argemone alba Lestib.			5
Lepidium virginicum L.			2½
Baptisia leucantha T. & G.		4	5½
Amorpha canescens Nutt.	3	3	4¾
Kuhnistera candida (Willd.) Kuntze. (Petalostemon candidus Michx.)		2	3¼
Acuan illinoensis (Michx.) Kuntze (Desmanthus brachylobus Benth.)	4	3	8
Meriolix serrulata (Nutt.) Walp. (Oenothera serrulata Nutt.)	1¼	1½	2½
Gaura biennis L.	8	5	10½
Apocynum cannabinum L	3		8
Marrubium vulgare L.		3	3½
Datura tatula L. (Ohio).		5	7
Verbascum thapsus L. (Ohio)		7	8
Cicuta maculata L	6	6	7⅓
Symphoricarpos symphoricarpos (L) MacM. (S. vulgaris Michx.)		5	8
Dipsacus fullonum L. (Ohio).		6	7½
Legouzia perfoliata (L.) Britt. (Specularia perfoliata A. D C.)	1⅔	2	3
Ratibida columnaris (Sims) D. Don. (Leptachys columnaris T. & G.)	2	2½	2⅛
Achillea millefolium L.		2	2½

CAMPUS BIRDS

A List of Birds Recorded by the Wheaton Ornithological Club, for the O. S. U. Farm and Campus.

Robert F. Griggs.

The first list of Campus birds was published by the Wheaton Club in the "Agricultural Student" for March, 1898. Since that time a number of additional species have been reported and it has been thought advisable to republish the entire list, inserting the additions in their proper places. The list below contains 187 species. It is compiled from the records of the Wheaton Club, excepting those species for which Prof. J. R. Taylor is given credit. Only those species of which nests, eggs, or fledgelings have been observed are reported as breeding. The names are preceded by the A. O. U. check list number. Further additions will be published from time to time.

Ord. Pygopodes

Fam. Podicipidae. Grebes.

6. Podilymbus podiceps (Linn.) Pied-billed Grebe, occasional.

Ord. Anseres

Fam. Anatidae. Ducks, Geese, etc.

137. Anas americana Gmel. American Widgeon, Bald-pate, occasional.
154. Clangula hyemalis (Linn.) Old squaw, occasional.
172. Branta canadensis (Linn.) Canada Goose, regular migrant.

Ord. Herodiones.

Fam. Ardeidae. Herons and Bitterns.

190. Botaurus lentiginosus (Montag.) American Bittern.
191. Ardetta exilis (Gmel.) Least Bittern accidental. (J. R. Taylor.)
194. Ardea herodias Linn. Great Blue Heron
201. Ardea virescens Linn. Green Heron, common, breeds.

Ord. Paludicolae.

Fam. Rallidae. Rails, Gallinules, etc.

221. Fulica Americana Gmel. Coot, occasional.

Ord. LIMICOLAE.

Fam. SCOLOPACIDAE. SNIPES, SANDPIPERS, etc.

228. Philohela minor (Gmel.) American Woodcock.
230. Gallinago delicata (Ord.) Wilson's Snipe.
256. Totanus solitarius (Wils.) Solitary Sandpiper, occasional.
263. Actitis macularia (Linn.) Spotted Sandpiper, common.

Fam. CHARADRIIDAE. PLOVERS

273. Ægialitis vocifera (Linn.) Killdeer, common, breeds.

Ord. GALLINAE

Fam. TETRAONIDAE. GROUSE, etc.

289. Colinus virginianus (Linn.) Quail, generally one or two flocks, breeds

Ord. COLUMBAE.

Fam COLUMBIDAE. PIGEONS and DOVES

316. Zenaidura macroura (Linn.) Mourning dove, abundant, breeds

Ord. RAPTORES.

Fam CATHARTIDAE. AMERICAN VULTURES

325. Cathartes aura (Linn.) Turkey Buzzard, occasional.

Fam FALCONIDAE. HAWKS.

333. Accipiter cooperi (Bonap.) Cooper's hawk, occasional.
337. Buteo borealis (Gmel.) Red-tailed hawk, occasional.
343. Buteo latissimus (Wils.) Broad-winged hawk.
360. Falco sparverius Linn. American sparrow hawk, common, breeds.
364. Pandion haliaetus carolinensis (Gmel.) American Osprey, accidental, reported by Mr. C. B. Morrey, during a spring flood.

Fam. BUBONIDAE. HORNED OWLS.

373. Megascops asio (Linn.) Screech Owl, common, breeds.
375. Bubo virginianus (Gmel.) Great Horned Owl, occasional.

Ord. COCCYGES.

Fam. CUCULIDAE. CUCKOOS, etc

387. Coccyzus americanus (Linn.) Yellow-billed Cuckoo, common, breeds.
388. Coccyzus erythrophthalmus (Wils.) Black-billed Cuckoo.

Fam. ALCEDINIDAE. KINGFISHERS.

390 Ceryle alcyon (Linn) Belted King-fisher, common, breeds.

Ord PICI.

Fam PICIDAE. WOODPECKERS.

393. Dryobates villosus (Linn) Hairy Woodpecker, common, resident.
394. Dryobates pubescens (Linn.) Downy Woodpecker, common, resident, breeds
402. Sphyrapicus varius (Linn) Yellow-bellied Sapsucker, migrant.
406. Melanerpes erythrocephalus (Linn) Red headed Woodpecker common, breeds
409. Melanerpes carolinus (Linn) Red-bellied Woodpecker, resident
412 Colaptes auratus (Linn.) Flicker, common resident, breeds.

Ord. MACROCHIRES.

Fam CAPRIMULGIDAE. NIGHT-HAWKS, etc

417 Antrostomus vociferus (Wils.) Whip-poor-will.
420 Chordeiles virginianus (Gmel) Night-hawk.

Fam MICROPODIDAE. SWIFTS.

423. Chaetura pelagica (Linn) Chimney Swift, common, breeds.

Fam TROCHILIDAE HUMMINGBIRDS

428. Trochilus colubris (Linn) Ruby-throated Hummingbird.

Ord. PASSERES.

Fam. TYRANNIDAE FLYCATCHERS.

444. Tyrannus tyrannus (Linn) Kingbird, common, breeds.
452. Myiarchus crinitus (Linn) Crested Flycatcher.
456. Sayornis phoebe (Lath) Phoebe, common.
461 Contopus virens (Linn.) Wood Pewee.
466a. Empidonax traillii (Aud) Traill's Flycatcher, breeds.
467. Empidonax minimus Baird Least Flycatcher. (J. R. Taylor.)

Fam. ALAUDIDAE. LARKS.

474. Otocoris alpestris (Linn.) Shore Lark, winter visitant.
474b. Otocoris alpestris praticola Hensh. Prairie Horned Lark.

Fam. CORVIDAE. CROWS, etc.

477. Cyanocitta cristata (Linn.) Blue Jay, common resident, breeds.

488. Corvus americanus Aud. Crow, seen at all seasons.

Fam. ICTERIDAE. BLACKBIRDS, etc.

494. Dolichonyx oryzivorus (Linn.) Bobolink, common

495. Molothrus ater (Bodd.) Cowbird, common, breeds

498 Agelaius phoeniceus (Linn.) Red-winged Blackbird

501 Sturnella magna (Linn.) Meadow Lark, common, breeds.

506. Icterus spurius (Linn.) Orchard Oriole

507. Icterus galbula (Linn.) Baltimore Oriole, common, breeds.

509. Scolecophagus carolinus (Mull.) Rusty Blackbird.

511b. Quiscalus quiscula aeneus (Ridgw.) Bronzed Grackle, Crow Blackbird, common, breeds abundantly.

Fam. FRINGILLIDAE. FINCHES and SPARROWS.

517 Carpodacus purpureus (Gmel.) Purple Finch.

—. Passer domesticus (Linn.) English Sparrow, superabundant, breeds

529 Spinus tristis (Linn.) American Goldfinch, common.

533. Spinus pinus (Wils.) Pine Siskin

540 Poocaetes gramineus (Gmel.) Vesper Sparrow, common, breeds

542a. Ammodramus sandwichensis savanna (Wils.) Savannah Sparrow.

546 Ammodramus savannarum passerinus (Wils.) Grasshopper Sparrow, almost certainly breeds though no nest has been found

552 Chondestes grammacus (Say) Lark Sparrow.

554 Zonotrichia leucophrys (Forst.) White-crowned Sparrow.

558 Zonotrichia albicollis (Gmel.) White-throated Sparrow.

559 Spizella monticola (Gmel.) Tree Sparrow, common, winter resident

560 Spizella socialis (Wils.) Chipping Sparrow, common, breeds.

563. Spizella pusilla (Wils.) Field Sparrow.

567. Junco hyemalis (Linn.) Snow-bird, common, winter resident.

581. Melospiza fasciata (Gmel.) Song Sparrow, abundant, resident, breeds.

583. Melospiza lincolni (Aud.) Lincoln's Sparrow.

584. Melospiza georgiana (Lath.) Swamp Sparrow.

585. Passerella iliaca (Merr.) Fox Sparrow.

587. Pipilio erythropthalmus (Linn.) Towhee, common resident.

593. Cardinalis cardinalis (Linn.) Cardinal, common resident, breeds.
598. Passerina cyanea (Linn.) Indigo Bunting, common, breeds.
604. Spiza americana (Gmel.) Dickcissel.

Fam. Tanagridae. Tanagers.

608. Piranga erythromelas Vieill. Scarlet Tanager.
610. Piranga rubra (Linn.) Summer Tanager, May, 4, 1899. (J. R. Taylor.)

Fam. Hirundinidae. Swallows.

611. Progne subis (Linn.) Purple Martin, common.
613. Chelidon erythrogaster (Bodd.) Barn Swallow, common, breeds.
617. Stelgidopteryx serripennis (Aud.) Rough-winged Swallow.

Fam. Ampelidae. Waxwings.

619. Ampelis cedrorum (Vieill.) Cedar-bird, Cherry-bird.

Fam Laniidae Shrikes

622. Lanius ludovicianus Linn. Loggerhead Shrike.

Fam. Vireonidae. Vireos

624. Vireo olivaceus (Linn.) Red-eyed Vireo, breeds.
627. Vireo gilvus (Vieill.) Warbling Vireo, common spring migrant.
628. Vireo flavifrons Vieill. Yellow-throated Vireo
629. Vireo solitarius (Wils.) Blue-headed Vireo.

Fam. Mniotiltidae. Wood Warblers.

636 Mniotilta varia (Linn) Black and White Creeper, common migrant.
639. Helmitherus vermivorus (Gmel) Worm-eating Warbler.
641. Helminthophila pinus (Linn.) Blue-winged Warbler.
642. Helminthophila chrysoptera (Linn.) Golden-winged Warbler. (J. R. Taylor.)
645. Helminthophila ruficapilla (Wils) Nashville Warbler. (J. R. Taylor.)
647. Helminthophila peregrina (Wils) Tennessee Warbler.
648. Compsothlypis americana (Linn.) Parula Warbler
650. Dendroica tigrina (Gmel.) Cape May Warbler.
652. Dendroica aestiva (Gmel.) Summer Warbler, common, breeds.
654. Dendroica caerulescens (Gmel.) Black-throated, Blue Warbler

655. Dendroica coronata (Linn.) Yellow-rumped Warbler, Myrtle Warbler.
657. Dendroica maculosa (Gmel.) Magnolia Warbler.
659. Dendroica pensylvanica (Linn.) Chestnut-sided Warbler.
660. Dendroica castanea (Wils.) Bay-breasted Warbler.
661. Dendroica striata (Forst.) Black-poll Warbler, common fall migrant
662. Dendroica blackburniae (Gmel) Blackburnian Warbler.
667. Dendroica virens (Gmel.) Black-throated Green Warbler.
671 Dendroica vigorsii (Aud.) Pine Warbler.
672. Dendroica palmarum (Gmel.) Palm Warbler.
674. Seiurus aurocapillus (Linn.) Ovenbird
675. Seiurus noveboracensis (Gmel) Water-thrush.
676. Seiurus motacilla (Vieill.) Louisiana Water-thrush. (J. R. Taylor)
677. Geothlypis formosa (Wils.) Kentucky Warbler.
678. Geothlypis agilis (Wils) Connecticut Warbler.
681. Geothlypis trichas (Linn) Maryland Yellow-throat.
683. Icteria virens (Linn.) Yellow-breasted Chat, breeds.
684. Sylvania mitrata (Gmel.) Hooded Warbler
685. Sylvania pusilla (Wils.) Wilson's Warbler. (J. R. Taylor.)
687. Setophaga ruticilla (Linn.) American Redstart, common migrant.

Fam TROGLODYTIDAE WRENS, etc.

704. Galeoscoptes carolinensis (Linn.) Cat-bird, common, breeds abundantly.
705. Harporhynchus rufus (Linn.) Brown Thrasher, common, breeds.
718. Thryothorus ludovicianus (Lath.) Carolina Wren, common resident, breeds.
721. Troglodytes aëdon Vieill House Wren, common, breeds.
722. Troglodytes hiemalis Vieill. Winter Wren.

Fam. CERTHIIDAE. CREEPERS.

726. Certhia familiaris americana (Bonap.) Brown Creeper, common winter visitant

Fam. PARIDAE. NUTHATCHES, etc.

727. Sitta carolinensis Lath. White-breasted Nuthatch, common resident.
728. Sitta canadensis Linn Red-breasted Nuthatch, migrant.
731. Parus bicolor (Linn.) Tufted Titmouse, common resident.
735. Parus atricapillus (Linn.) Chicadee.

Fam. SYLVIIDAE. KINGLETS, etc.

748. Regulus satrapa Licht. Golden-crowned Kinglet, common.
749. Regulus calendula (Linn.) Ruby-crowned Kinglet.
751. Polioptila caerulea (Linn.) Blue-gray Gnatcatcher.

Fam TURDIDAE. THRUSHES, etc

755. Turdus mustelinus Gmel Wood Thrush, common, breeds.
756. Turdus fuscescens Steph. Wilson's Thrush, Veery
757. Turdus aliciae Baird. Gray-cheeked Thrush.
758a Turdus ustulatus swainsonii (Cab.) Olive-backed Thrush.
759b. Turdus aonalaschkae pallasii (Cab.) Hermit Thrush
761. Merula migratoria (Linn.) American Robin, abundant, breeds
766. Sialia sialis (Linn.) Bluebird, common.

MINOR PLANT NOTES No. 1.

W. A. KELLERMAN.

An introductory paragraph to this series may be short as will be the notes that follow. Suffice therefore to say that from time to time the field jottings and short notes of observations on the plants of our State flora will be presented. Not only those made myself but others which may be kindly communicated to me for this purpose by botanists, amateurs, students and other observers will find a place in the series. An especial invitation is extended to pupils in our High Schools and to teachers throughout the State to contribute suitable material which in many cases may be of great interest and importance Sub-heads will be used thus making it possible to scan the notes easily

PUCCINIA SMILACIS.—This Black Rust which has the various species of Green Briar for its host, was noticed in extraordinary quantity the past season in Scioto, Adams and Brown Counties It was abundant only on Smilax glauca—called in that region the Saw Brier—but not uncommonly occurred on S hispida and S rotundifolia. It was also remarkable in this respect namely that the teleutospores (the black or winter spores) were excessively abundant · the uredospores (red or summer spores) could be found only when search was made The observation here recorded pertains to the first half of the month of November. I have occasionally noticed uredospores in quantity on Smilax leaves in the various parts of Ohio but never before found the winter-spores common. It should perhaps be added parenthetically that *Dicæoma* having the priority over Puccinia is really the generic name that should be used, but the commoner designation may here be tolerated.

QUERCUS ACUMINATA.—The Chestnut or Yellow Oak (name in Gray's Manual Quercus Muhlenbergii) is described as "a tall tree with thin *flaky* bark" (Gray), or "a tree with gray *flaky* bark" (Britton); and in fact many of the White Oaks are said to have "*flaky*" bark. The Quercus acuminata is very abundant in central Ohio and is of common occurrence in many parts of the State. It is rare that the "flakiness" of the bark or a tendency to separate in plates, is pronounced or conspicuous in our Chestnut Oak trees The single good example I have found is here shown in Fig. 1 reproduced from a photograph of a specimen growing in Hayden's ravine near Columbus. Both trees shown are the same species but the smaller one has merely furrowed, not flaky, bark, and it is a fair representative of the trunks of this Oak as they occur in our vicinity. The usual form of bark is perhaps more clearly shown in Fig. 2, which is from a photograph of a large tree standing near the Horticultural Hall of the Ohio State University. This specimen has leaves remarkably narrow for Q. acuminata but the trunk is similar in appearance to the trees which have broad leaves

Fig 1.

Fig. 2

HELIANTHUS MAXIMILIANI.—Maximilian's Sunflower whose habitat and range are given in Britton and Brown's Illustrated Flora as "on dry prairies, Minnesota, and Manitoba to the Northwest

Territory, Nebraska and Texas" may be said to be out of place in Ohio. Yet Mr. R. F Griggs found it (a single plant) in the season of 1900 (cf. O. S U NATURALIST, 1:16) at Sandusky, Erie County. In a package of interesting plants sent to the State Herbarium recently by Mr Otto Hacker, fine herbarium specimens of this conspicuous species were furnished. Mr. Hacker says that he observed it near Painesville (Lake County) six or seven years ago by railway tracks, where it is still flourishing.

LOTUS CORNICULATUS — This European Lotus, with such common names as Bird's foot, Trefoil, Ground Honeysuckle, Bloom-fell, Crowtoes, Cat's-clover, and Sheepfoot, was collected at Painesville by Mr. Otto Hacker in nursery grounds. This is the second time this waif has been recorded for Ohio, the first case being reported by Mr. Ricksecker, of Oberlin

NEWS AND NOTES.

Prof. Thomas A Williams, editor-in-chief of the Asa Gray Bulletin and assistant chief of the Division of Agrostology, U. S. Department of Agriculture, died on the morning of Dec. 28, 1900.

At the 10th annual meeting of the Ohio State Academy of Science, held at Columbus, on December 26 and 27, thirty-one papers were read—12 pertaining to botany, 8 to zoology, 6 to geology, 3 to meteorology, and 2 to anthropology. The following are the officers for the coming year: President, August D. Selby, Wooster; 1st Vice Pres , Rev. H Herzer, Marietta, 2nd Vice Pres , Mrs. W. A. Kellerman, Columbus, Secretary, E. L Moseley, Sandusky; Treasurer, Herbert Osborn, Columbus; members of executive committee besides the president, secretary and treasurer, Thos Bonser, Carey; Lynds Jones, Oberlin; trustees, F. M Webster, Wooster; H. C Beardslee, Cleveland, W R. Lazenby, Columbus, publication committee, F. M. Webster, Wooster; John H. Schaffner, Columbus; L. H. McFadden, Westerville, Librarian, W. C. Mills, Columbus.

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Since some criticism has been made, both at home and abroad, on the name of THE O. S. U NATURALIST, it has been thought best to make a slight change by dropping the words, State University. Although a change in name is unfortunate it will not be very serious at the present time and hereafter the name will be THE OHIO NATURALIST, which is perhaps more descriptive of the scope of the journal and much better for purposes of citation.

J. H. S.

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THE CORNING OIL AND GAS FIELD.*

J. A. Bownocker

Area.—This field lies in the three counties, Athens, Perry and Morgan. Leaving out of consideration at present a few small outlying pools, and starting at the south, the productive territory may be said to begin in Section 22, Trimple township, Athens county. From this point it runs almost due north to the Perry county line. The widest part of this portion of the field does not exceed one-half mile, while the narrowest portion permits of a single row only of wells.

It enters Monroe township, Perry county in Section 33, and runs almost due north towards Corning, but bends to the northeast about one mile south of that place Here the productive territory attains a maximum width of 3 miles, the greatest in the field. The northeast course is continued to the Morgan county line, where it turns due north, skirting that line with a productive strip about one-half mile mide for 2½ miles, when it turns slightly to the east, entering Morgan county in Section 31 of Deerfield township. From that place it extends through Section 30 and into Section 19, beyond which it has not been traced Development of this part of the field is retarded by floods of salt water which may limit it in this direction. The total length of the field is about 14 miles.

Outside of this belt are four pools, two of which are of little importance. One lies around Glouster, and has an area of less than one square mile. A second one lies in Sections 22 and 29, a short distance northwest of Glouster This is the principal territory from which the gas of Corning and surrounding towns is derived. A third pool lies around Porterville, and the fourth known as the Oakfield lies from 3 to 5 miles north of Corning It includes parts of sections 5, 21, 28, 29, 32, and 33 of Pleasant and 22, 27 and 34 of Bearfield townships. It is in this pool that the most extensive work is being done at the present time.

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* Published by permission of Edward Orton, Jr , State Geologist

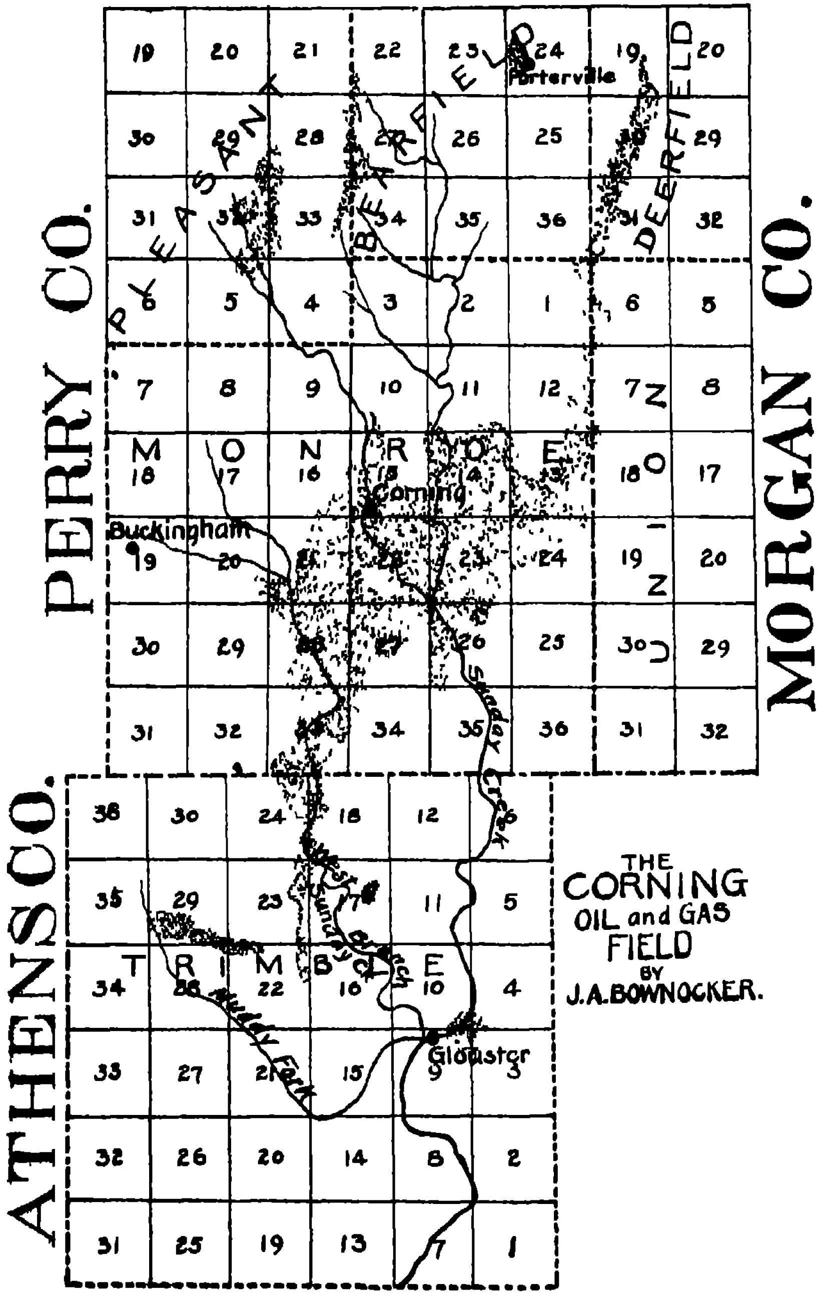
DISCOVERY.—Probably the first deep well drilled in the Sunday Creek Valley was near Burr Oak, about 4 miles south of Corning. Its date is not now known, but it must have been 40 or more years ago. Its depth is likewise unknown, but it is reported to have penetrated the salt sand. To this day it flows salt water, and with it sufficient gas to be ignited. This well, however, seems not to have aroused suspicion that there might be valuable liquids other than salt water buried in the rocks.

The discovery of oil in the Corning field was a matter of accident, and resulted directly from a scarcity of water for the Toledo and Ohio Central railroad. To remedy this a deep well was drilled in August, 1891, at the round house, about three-fourths of a mile south of Corning. The only water found was in the salt sand which is reported as having been struck at a depth of 680 feet. The supply was copious, but the salinity prevented its being used in locomotives. This brine was shut out of the well by casing and the drill forced down to a depth of 1507 feet. Finding no water at that depth the work ceased, but a few days later oil was thrown to the top of the derrick, and there were smaller eruptions later. However further disturbances of this sort were prevented by the company closing the well.

DEVELOPMENT.—The disclosure made by this well attracted the attention of oil men who immediately entered the field and began leasing territory. The citizens of Corning feared the territory was falling into the hands of the Standard Oil Company, and that it might not under such conditions be developed for years. Accordingly a home company styled "The Sunday Creek Oil & Gas Company," was organized in February, 1892, to make certain the development of the territory The capital stock was placed at $10,000 in shares of $50, and $8900 of the stock was sold. Much of this was raised by citizens of the town subscribing for single shares.

The new Company was successful. By January 1st 1898, 255% in dividends had actually been paid the stock holders. In September, 1898, a power for pumping the wells, and costing over $7000, was erected, the contractor taking the product of the wells until it paid for the plant. In November, 1899, the property together with $1250—the amount received in excess of the cost of the plant—was turned over to the original holders. The power is now (July 1, 1900,) pumping 20 wells, which have a daily production of 40 barrels.

The first well drilled by this Company was on the William Fisher farm in northwest quarter section 14, Monroe township, Perry county. The Berea was struck at 1012 feet, but the indications were so unfavorable for a paying well that it was not considered advisable to shoot it. However, on June 2d, 1892, after waiting nearly a month, the well was shot with 80 quarts of nitro-glycerine, which had been hauled from Sistersville, W. Va. The cost of the shot was $200. The



THE
CORNING
OIL and GAS
FIELD
BY
J.A.BOWNOCKER.

first day following the shooting of the well it produced 12 barrels, and a year later was still producing 10 barrels per day. Following this other wells were drilled in sections 14 and 15. In all 25 have been drilled, only 8 of which were dry holes.

Other companies began work and the territory was rapidly leased and tested. Naturally operations began near the round house where oil had first been shown to exist. From this as a center the drill moved out in all directions until the limits of the field had been disclosed. The later work has been along the northeast end of the territory in Morgan county, where the oil seems to be shut out by reservoirs of salt water. During the present summer (1900) the valuable pool in the Oakfield district has been developed, though small wells had been found there several years earlier The principal farms are the Porter, Longstreth, Donnelly, Monahan, McDonald and Grenen. The first well was on the Porter farm and was finished early in 1900. Its production was 85 barrels the first day. The second well was on the Monahan farm. It was completed soon after the Porter well and had an initial flow of 45 barrels in 24 hours. The next two wells were drilled on the Longstreth farm, and both were fair producers. Early in the Spring'a well was completed on the Donnelly farm and flowed 125 barrels the first day. Other wells on this farm are much smaller Two wells on the Grenen farm began flowing 675 and 90 barrels respectively. It is interesting to note that the development of this, the richest part of the Corning field, occurred late in the territory's history. Possibly other pools of equal richness may yet be discovered lying near the principal field.

An important step in the development of the field occurred on August 18th, 1893 when the Buckeye Pipe Line was completed. Before that the oil was transported by tank cars. The oil which is brought to the tanks partly by gravity and partly by suction, the latter being produced by an 8 horse-power gas engine, is stored in two iron tanks, one of which has a capacity of 30,000, and the other 28,000 barrels. From these tanks the oil is forced to Elba, a distance of 34 miles, through a 4 inch line. This work is done by a 35 horse power engine which gives a pressure in the line of from 700 to 1000 pounds per square inch. The rate at which the oil is transported varies with the temperature. In the summer when the oil is warm, and hence thin, 128 barrels may be pumped in one hour, but in the winter when the oil is cold and thick the transportation may be restricted to 11 barrels for the same period.

When the pipe line was completed the production of the field was about 500 barrels per day. It increased to 1800 barrels in 1896, but since then has declined. At present it ranges from 800 to 900 barrels per day. The total production of the field is shown by the following letter:

The Buckeye Pipe Line Company—Macksburg Division.
Oil City, Pennsylvania, October 25th, 1900.

J. A. Bownocker, Esq., Columbus, Ohio:

Dear Sir—Your favor of October 18th to Superintendent N. Moore, asking for the total production by years of the Corning Field, has been referred to me. Below please find the figures of oil received by The Buckeye Pipe Line Company from the Corning Field from August, 1893, to September, 1900:

Part of Year 1893	128,918.03	Bbls.
Year 1894	322,318.71	"
Year 1895	428,385.03	"
Year 1896.	469,258.78	"
Year 1897	328,188.11	"
Year 1898.....	196,417.75	"
Year 1899......	211,060 22	"
January 1st to July 31st, 1900..	148,314.96	"
August, 1900	26,929 66	"
September, 1900.	22,517.67	"
Total		2,277,808.90 Bbls.

July 31st, 1900, completes the first seven years production and thinking you might prefer to use the even years, I have given you the figures for the year 1900 to July 31st in one lump and the oil taken from that field for the months of August and September separately.

Trusting this will answer your purposes, I remain
Yours truly,
J. R. Campbell, Treasurer.

Leases.—At first the operators paid no bonuses, but gave a royalty of one-eighth of the oil to the land owners—a rate of compensation that has been usually maintained. To this there is one exception worthy of note When the round-house well showed the existence of oil, and operators began leasing the surrounding territory, Fredrick Weaver, a thrifty German farmer residing a short distance east from the round-house, quietly visited the oil fields of Washington, Pennsylvania, and investigated the methods of leasing oil territory in that field. When he returned home he demanded a royalty of one-fourth the oil and a bonus of $200 for each of the eight wells which it was proposed should be drilled on his farm of eighty acres, and since his territory was regarded as very promising, these rather severe terms were granted. However, after drilling six wells, and the territory not meeting expectations, the contractors complained and Mr. Weaver generously reduced the bonus. More recently a royalty of one-sixth the oil has been received by holders of lands that were deemed especially promising, and bonuses also have been received. The leases usually required that a well be drilled in from thirty to sixty days, but sometimes, especially in the least promising territory, six months were allowed.

That the field was a monopoly for no one is shown by the following list, which includes the chief operators of the district:

Corning Oil Company.
Denman & Thompson.
O'Connel Oil Company.
Brooks Oil Company.
Caldron & Snyder.
Sunday Creek Oil & Gas Company.
Perry County Oil Company.
W. B Barker & Company.
Cleveland Oil Company.
Keystone Oil Company.
W. E. Detlor.
William Rosler
J. H. Van Wormer.
Northeast Oil Company.
Becker Oil Company.
Allen, Sternberg & Company.
Bolivar Oil Company.
William McMullen.
A. Bulger & Company.
Corning Natural Gas Company.
L. D. Langmade.
Harrington Brothers.
Ohio Oil Company
Church Oil Company
Monroe Oil & Gas Company.
Weaver Brothers
W. B. Irwin & Company.
George Best & Company.
Foster & Moran.
Fallen Rock Company.
Ohlviler & Chambers.
Mill Oil Company.
Hemlock Oil Company.
John Holden.
Wells & Foraker
Longfellow & Stevens.
Russell Metzger.
McGee & Stewart.
Stratton & Mark.
National Oil Company.

GEOLOGY OF THE REGION.—The surface of the territory lies in the Lower Productive and Lower Barren coal measurers. The highest hills reach up to or extend above the Ames or Crinoidal limestone. In fact along the northeast extremity of the field the hills are capped by the limestones which underlie the Pittsburgh coal. The deepest valley—that of Sunday Creek—cuts through the Middle Kittanning coal, a short distance north of Corning, but at this town the seam named is under cover, while the Upper Freeport coal is at about drainage level.

The succession of strata under ground is shown by the following record kept and furnished the Survey by Mr. G. W. Delong, Superintendent of Schools, Corning. The well is located on lot 154 of the town just named, and the top of the well lies at the base of the Mahoning sandstone:

	Thickness of Stratum	Total Thickness
Shale	25 feet	25 feet
Bastard Lime	15 "	40 "
Sand	10 "	50 "
Coal (No. 6)	10 "	60 "
White Slate	65 "	125 "
Sand	15 "	140 "
White Slate	25 "	165 "
Blue	10 "	175 "
Sand	10 "	185 "
Slate	50 "	235 "
Shale	35 "	270 "
Sand	30 "	300 "
Black Shale	10 "	310 "
Lime	25 "	335 "
Shale with Concretions	100 "	435 "
Slate	25 "	460 "
Limestone (?)	30 "	490 "
Shale	35 "	525 "
Salt Sand	30 "	555 "
White Slate	100 "	655 "
Slate and Concretions	25 "	680 "
Shale	15 "	695 "
Little Salt Sand	20 "	715 "
White Slate	100 "	815 "
Slate and Concretions	100 "	915 "
Brown Shale	40 "	955 "
Black Shale	38 "	993 "
Top Berea		998 "
Bottom of Berea		1008 "

The depth of the well as shown by the steel line is 1012¾ feet. It was drilled in the Fall of 1896, and was shot with twenty quarts of nitro-glycerine. It began flowing thirty barrels per day, but the production has diminished until at present it is producing only one barrel per day. Below the Berea the Bedford shales are found in their normal conditions.

THE OIL SAND.—This is in all cases the Berea. The sand has the light gray color so common in this formation in other parts of the state. It is moderately fine grained, but there is considerable variation in this respect. Usually it is a pure quartz sand, but occasionally has thin layers of dark shaly material running through it. In thickness it shows considerable variation, but never disappears in this field. The normal thickness is usually given as twenty feet and the maximum reported is eighty feet. This depth was found on the Potts farm about one and one-fourth miles northeast of Corning, and on the O'Farrell farm about two miles east from the same town. In both cases a dark gray shale, probably the Ohio, lay below. The Bedford on this theory had been swept away before the Berea was deposited. In such abnormal depths the additions always appear to be on the bottom, showing that the surface of the underlying Bedford shale was quite uneven. Here, as elsewhere in the state, the drill shows the upper surface of the Berea to be uniform. It is worthy of note that the production of oil does not vary as the thickness of the sand. In fact in this field the great thicknesses are generally poor producers.

The "pay streak" or that containing the oil and gas ranges in thickness from 3 to 8 feet, but very few of the wells attain the maximum figure. Towards the margin of the prodctive field the "pay streak" thins, and finally disappears. The top of the "pay" usually lies from 10 to 15 feet below the surface of the Berea. As a rule the "pay" is coarser than other parts of the Berea, and generally the coarser the rock the larger the well. Sometimes in the thick part of the Berea there are two "pay streaks."

THE WELLS.—The number of wells producing July 1, 1900, exceeded 600. About 100 dry holes have been drilled and about an equal number of wells have been abandoned, so that 800 is a fair approximation of the total number of wells drilled in the field. As a rule a well has been put down for each 8 to 10 acres of surface territory.

The wells have been cased through the salt sand, a depth of 555 feet in the valley at Corning. The casing has almost invariably been 5⅝ inches, inside measurement. The rocks comprising the underlying 160-180 feet, and terminating with the "Little Salt Sand" have furnished some water which has been disasterous to the wells. It reduced the gas pressure, thus necessitating pumping the wells earlier than otherwise would have been required and perhaps prematurely destroying the life of the well. Had the wells been cased through the "Little Salt Sand" time and money would have been saved, and the production of the field would have been larger.

The western side of the field is quite free from salt water. It is on that side that the principal gas territory lies On the easern side of the field the conditions are more variable. In Trimble township, Athens county, the wells are free from water, while in Monroe township, Perry county, salt water is found in the northeast corner, and in Morgan county it is so abundant that operating is prevented. From this it appears that the western side of the Corning field is free from salt water, and that it is absent also on the eastern side at the southern margin of the territory, but that it increases rapidly to the northeast.

While the production of the wells after being shot has varied greatly, yet they have not furnished the great extremes that many other fields have. Few, if any of the wells, have started better than 125 barrels per day, and it has been estimated that the average for the entire field has been 20 barrels

The wells have sufficient gas pressure to flow them during the earlier part of their lives, but later as the pressure diminishes they have to be pumped Since the eastern side of the field has salt water the wells there have to be pumped earlier than those on the western side.

THE GAS WELLS.—The principal gas territory is that along Muddy Fork in Sections 22 and 29 Trimble township, Athens county, the best wells being found in the western half of the latter section on the lands of the Hocking Coal and Railroad company The largest well in this field started at 3,000,000 cubic feet per day with a rock pressure of 400 pounds It was drilled in the fall of 1897, and one year later was producing 2,000,000 cubic feet per day, and still another year later 1,500,000 cubic feet. Of the other wells in this territory two started at 2,000,000 feet each, two at 1,000,000 feet each, and three at 500,000 feet each The decline in the smaller wells was not as rapid as in the larger ones since the demands made on them were not as heavy. Thus far no dry holes have been found in this territory. The reliance of the community is on this field where 5,000 acres are leased in one block.

Another district that has yielded considerable gas is that at Oakfield about 3 miles north of Corning These wells started at 2,000,000, 1,500,000, 500,000, and 250,000 cubic feet per day respectively. Two of the smaller of these have been abandoned after having produced for two years. The largest of these wells, now four years old, is producing 500,000 cubic feet per day, and the second largest, now three years old, is producing the same amount. The wells in this field produce considerable oil and by some are rated as oil wells rather than gas ones.

Outside of these two places an occasional strip is found that produces gas in paying quantities. Thus about one mile northeast of Corning two wells were drilled, which combined produced 500,000 cubic feet per day. They produced three years and were then abandoned. About two miles north of Corning a good well was drilled on the Newberry farm. It started at 1,500,000 cubic feet per day, had an initial rock pressure of 400 pounds and lasted three years.

Another productive tract lies about 6 miles northeast of Corning on the Finley, Devore and Stoneburner farms. Three wells were drilled on the Finley farm, and started one at 1,500,000 and two at 250,000 cubic feet, with an initial rock pressure of 400 pounds. These wells lasted three years.

The operators of the wells have been much troubled with salt water in the Muddy Fork field and with oil in the Oakfield territory. Salt water is removed by "blowing" the wells For this operation the wells are closed for a short period, usually about 30 minutes, allowing the gas pressure to increase; when this has become sufficiently strong the well is opened at the top and the gas then blows the water from the well. When the well has been cleansed in this manner it is closed and the gas turned back into the mains. Sometimes, however, the weight of the water is so great that the gas cannot drive it from the well in the manner just stated, especially is this true with wells that have been in use for a considerable period. Then an iron rod attached to a long pole is let down through the water, is raised and lowered, and the gas following the pole in its ascent finally drives the water from the well. This method of cleaning is known as "agitating." Finally the pressure of the gas becomes so small that it cannot lift the water with the help of "agitating," and then the well is dead. In winter time each well is cleaned every other day, and in the summer twice a week.

The gas wells in the Corning field are owned and operated by the Corning Natural Gas Company. It supplies Jacksonville, Trimble, Glouster, Murray City, New Straitsville, Shawnee, Hemlock, Corning, Rendville, Moxahala, New Lexington, and several interior hamlets. Almost the sole use of the fuel is for heat and light.

The company makes a rate of 20 cents per thousand feet by meter. Where the meter is not used, the prices in winter are $2.00 per month for the first fire; $1.50 for the second; $1 00 for the third; 75 cents for the fourth, and all additional fires at the latter figure. In the summer a charge of $1.50 for each cooking fire is made. For lights the charges are 25 cents each for the first two and 15 cents for each additional one.

The number of customers supplied by this company in 1900 was approximately as follows:

Corning	300
Glouster	250
New Lexington	250
Shawnee	200
New Straitsville	150
Other places	350
Total	1500

In the Fall of 1899 the wells of the company produced 6,000,000 cubic feet per day, but during cold weather when the demand for fuel was great they dropped to 3,000,000 cubic feet, and the rock pressure which was 300 pounds in the Fall was only 200 during the winter. On July 7th, 1900, the rock pressure of the wells in the Muddy Fork field ranged from 170 to 280 pounds, indicating a considerable drop from that of the preceding autumn. The company expects to drill four additional wells during the ensuing fall (1900) in the Muddy Fork territory, and by so doing expects to keep three wells closed, and thus maintain a good rock pressure.

TWELVE ADDITIONS TO THE OHIO PLANT LIST

W. A. Kellerman.

The species named below have not been reported in the Fourth State Catalogue of Ohio Plants, in the First Annual Supplement, nor in "Additions to the Ohio Flora," O. S. U. Naturalist, 1·15. The serial number prefixed to each name indicates where in the Fourth State Catalogue the species should be inserted. The first collector and locality are given for each of the listed specimens.

82a. Potamogeton nuttallii Cham. & Schw., Nuttall's Pondweed. Donor's Lake, Wayne County, Ohio (Reported by A D. Selby before meeting of Ohio Academy of Science, December 27, 1900.)

488a. Juncus dichotoma Ell. Forked Rush. Cuyahoga County. (Edo Claassen.)

647a. Betula alba pendula Hortorum. Pendulous White Birch. Escaped; Painesville. (Otto Hacker.)

781a. Dianthus deltoides L. Maiden Pink. Escaped: Painesville. (Otto Hacker)

986a. Erysimum repandum L. Logan County. (A. D. Selby in report before Ohio Academy of Science, December 27, 1900.)

1117a. Lespedeza angustifolia (Ph) L. (L. capitata var. angustifolia Ph.) Narrow-leaf Bush-clover. Fulton County. (A. D. Selby in report at meeting of Ohio Academy of Science, December 27, 1900)

1211a. Rhamnus caroliniana Walt. Carolina Buckthorn Adams and Brown Counties. (W. A. Kellerman.)

1626a. Teucrium scorodonia L. European Germander. Escaped; Painesville, Lake County. (Otto Hacker.)

1650a. Gerardia besseyana Britt. (G. tenuifolia var. macrophylla Benth.) Bessey's Gerardia. Wooster. (J. W. T. Duvel; reported by A. D. Selby at meeting of the Ohio Academy of Science, December 27, 1900.)

1759a. Leontodon hastilis L. Dandelion. Escaped; Painesville, Lake County. (Otto Hacker.)

1766b Lactuca saligna L. European Wild Lettuce. Dayton. (A. D. Selby.)

1777a. Hieracium greenii Porter & Britt. Green's Hawkweed. Wayne County (Selby and Duvel, reported by A. D. Selby before meeting of Academy of Science, December 27, 1900.)

There were 2025 species reported in the Fourth State Catalogue (1899) for the State of Ohio This number was supposed to be approximately correct, since those of previous lists were discarded which are known to have been erroneously identified or were unquestionably beyond our range. In the First Annual Supplement sixty-nine additions were made, and in Additions to the Ohio Flora, (O. S. U. NATURALIST, 1:15) twenty-two more were recorded. Therefore those enumerated above bring our grand total to 2128 species of Pteridophytes and Spermatophytes

A NEW SPECIES OF GOMPHUS AND ITS NEAR RELATIVES.

JAMES S HINE.

Gomphus viridifrons n. sp. Length of the abdomen about 33 mm., hind wing about 27 mm.; black, face and occiput green, prothorax with anterior margin and three spots green or yellow; thorax green with spaces at base of wings, lateral suture and six bands before black, the two middle bands are abbreviated anteriorly and separated by the mid-dorsal carina which is very feebly green. Abdomen black, a dorsal band and sides of first two or three segments yellowish. a yellow spot at base of each of segments four to seven, and sides of eight and nine usually yellowish.

Abdominal appendages of the male straight, about as long as the tenth segment, from above, widest at base, gradually narrowed from apical third and acute at apex; from the side prominently widened at base, with a strong tooth beneath at two-thirds of the length. Hamules large, of nearly the same width for the whole length and ending behind in a hooked process Vulvar scale almost as long as the ninth abdominal segment, gradually narrowed, apical third divided and the two parts divaricate.

Described from fourteen males and a female taken at Loudonville, Ohio, June 14, 1900; and a male and female taken at Ohio Pile, Pa.—the latter two specimens by E. B. Williamson.

The species averages larger than either *brevis* or *abbreviatus* and may be separated from the former readily by its green face, by the striking differences in the vulvar lamina and by the hamules and male appendages. In *brevis* the tooth on the appendage is nearer the end and the space from it to appex is noticeably curved while in *viridifrons* this space is practically straight.

It has more points in common with *abbreviatus*, but in that species the vulvar scale is short and triangular, the hamules are smaller and shorter, and the tooth on the superior appendage of the male is much farther from the apex

Through the kindness of Dr. Calvert and Mr. Williamson I have at my disposal, specimens from which many of the accompanying drawings were made In *viridifrons*, *brevis* and *abbreviatus* I have made drawings from different specimens of the same species to show slight variations.

This is *Gomphus* sp. Williamson, Dragonflies of Indiana, 294.

A COMPARATIVE STUDY OF GOMPHUS FURCIFER AND VILLOSIPES.

James S. Hine.

It seems that nearly every author who has considered these two species has compared them. Considering general appearances they are much alike but can be separated easily by several details and as I have good material of both sexes of the two species before me, I thought it might be of consequence to consider in a comparative way some of their characteristics

The occiput in both sexes of *villosipes* bears a prominent tooth at the middle of its upper edge This tooth varies some in different specimens, it ends above in a single point or it may be widened and end above in three or more points In *furcifer* there is no tooth on the occiput in either sex

The vulvar scales are very different, in *villosipes* the part may be said to be triangular with the free sides curved and the apical part divided for about half the length of the scale. In *furcifer* its basal part is similar but the apical part is produced, giving quite a different form. In the former species the scale is about one-third as long as the ninth segment, while in the latter it is about three-eighths as long as that segment.

The abdominal appendages of the male are different. From dorsal view those of *furcifer* are rectangular with the inner distal angle very much produced inward and backward; in *villosipes* they are wide at base, oblong, with the outer distal part broadly rounded and the corresponding inner part produced directly backward. The hamules are characteristic and may be explained best by reference to the figures.

The two species are colored much alike but *furcifer* is darker. The tenth abdominal segment may be said to be yellow in both but in *furcifer* the sides of the segment are dark, oftentimes black.

They agree in habits, both preferring to fly over stagnant water where the males come to rest on floating objects or on the ground at the water's edge. I have observed the female of *furcifer* ovipositing in stagnant water among lily pads and other aquatic plants. Her flight is slow while thus engaged, and her actions more like a *Libellula* than the usual *Gomphus*

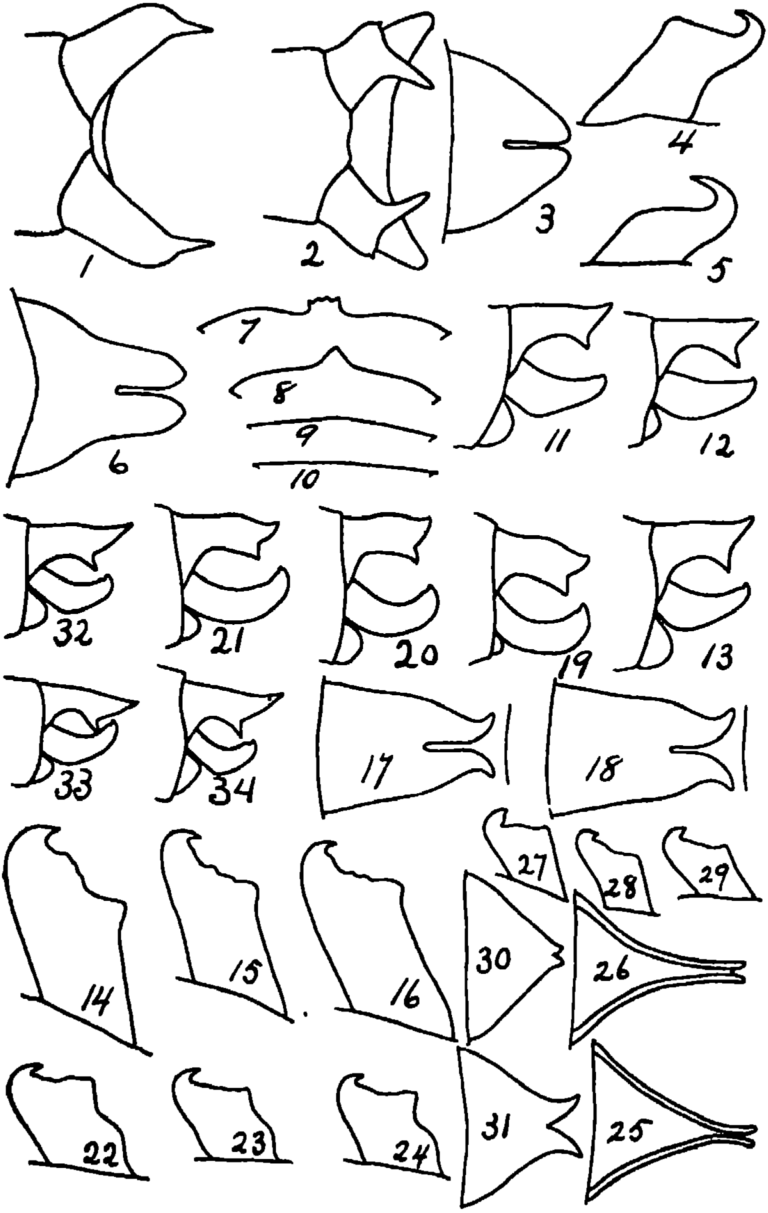
Gomphus villosipes—1, dorsal view of male appendages, 3, vulvar scale; 5 hamule; 7, occiput of female, 8, occiput of male.

Gomphus furcifer—2, dorsal view of male appendages; 4 hamule; 6, vulvar scale, 9, occiput of male; 10, occiput of female.

Gomphus viridifrons—11, 12, 13, dorsal view of male appendages —13 from Pa., 11, 12 from Ohio; 14, 15, 16, hamules; 17, 18, vulvar scales—18 from Pennsylvania, 17 from Ohio.

Gomphus brevis—19, 20, 21, dorsal view of male appendages—specimens from Maine and Pennsylvania; 22, 23, 24, hamules; 25, 26, vulvar scales.

Gomphus abbreviatus—27, 28, 29, hamules; 30, 31, vulvar scales; 32, 33, 34, dorsal view of male appendagages—specimens all from Maine.



HINE—GOMPHINE STUDIES.

NOTES FROM BOTANICAL LITERATURE

W. A. KELLERMAN.

A very interesting Bulletin of eight pages on the Chrysanthemum Rust has been issued by J C. Arthur, botanist of the Indiana Agricultural Experiment Station. It is No. 85, and is dated October, 1900. Dr Arthur gives a general account of Uredineae or Rusts, explaining that the typical forms have three prominent sets of spores, namely (1) aecidiospores, usually red or orange in little white cups, (2) uredospores, generally of a rusty yellow color and abundant (hence the group name, Rusts), and (3) teleutospores, or the Winter spores, usually dark brown or black. He further states that only uredospores have yet been found in Europe and America, and since the fungus is an annual, it is puzzling to see how it escapes extermination in winter and spring when Chrysanthemum plants are latent.

The assumption that this was the well known and common Puccinia hieracii or Puccinia tanaceti he proves to be incorrect by inoculation experiments. Uredospores from Chrysanthemums he sowed on Chrysanthemums and obtained a crop of uredospores. Similar uredospores sowed on Dandelion, Burdock, and Ox-eye Daisy produced no infection, uredospores from the latter hosts sown on Chrysanthemum likewise produced no infection. Uredospores from Dandelion sown on Dandelion produced uredospores. Others have tried similar experiments, using Tansy, Costmary, Orange Hawkweed, Giant Daisy, and Marguerite, besides the host plants named above, but the Chrysanthemum Rust refuses to grow on any of them. This Rust, which is common and well known on the Chrysanthemum in Japan, has been named Puccinia chrysanthemi by Rose.

In connection with suggestions relative to combating the disease, Dr. Arthur says that "so long as the teleutospores do not make an appearance in this country, the careful cultivator may feel assured that a moderate amount of timely effort will enable him to rid his establishment of the Rust, if he is so unfortunate as to have it donated to him by some careless florist. Observations made by the writer and others show that the tendency is for the disease to disappear of itself, to run its course in an establishment and die out, which is very likely to some extent due to the absence of teleutospores."

BRYOLOGY.—Mrs. Britton's popular articles on the Mosses and how to study them, that have appeared from time to time, furnished the directions and incentive to many who before had taken little or no interest in this group of plants. Her purpose and plan are imitated and extended in a charming little book, that has been prepared and published by Dr. A. J. Grout, of the Boys' High School, Brooklyn, New York, called "Mosses with a Hand-Lens." The author says that many years of study of Mosses in the field and in Herbaria have convinced him that "any person of average intelligence can easily learn to recognize seventy to one hundred common mosses, with the aid of a hand-lens of ten to fifteen diameters magnifying power."

I have Dr. Grout's permission to reproduce two illustrations, which represent fairly that phase of his valuable book. Figure 9 shows Ceratodon purpureus L., and the text pertaining to the same is as follows: "Ceratodon is one of the commonest of all our mosses. It is found on the edges of paths, roofs of old buildings, sand by the seashore, and in general any barren compact soil is its favorite habitat. The plants are short and grow close together, forming dense thin mats of dark green. The lance-like young sporophytes appear early in spring as soon as the snow is melted. By the middle of summer the capsules often decay beyond recognition, and the seta breaks from the plant at the touch.

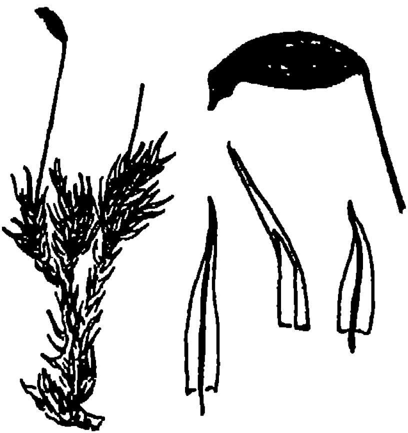


Fig 9. Ceratodon

Unless one has become very familiar with Ceratodon it is not always easy to recognize it without mature capsules. When the capsules have fully matured they shrink when dry and become furrowed. This peculiar furrowing, the dark rich color of the capsules, a color called purple by the older botanists, but which is really a very dark chestnut or red-brown, make it easy to recognize this species."

Plate II. shows the Hair-cap Mosses, Polytrichum, the largest of all our species. There are four common species all having square capsules which character distinguishes them from Pogonatums, the latter having cylindric capsules. "The Ohio Hair-cap without the sporophyte (seta and capsule, commonly called fruit) is not readily distinguished from the Common, as the leaves and general appearance are very similar But with the sporophyte present, the distinctions are clear. In figs b and d (Plate II.) note that the capsule of the Common Hair-cap is almost cubical, that the lid has a *very short beak*, and that the capsule is entirely covered by the calyptra. The capsule of the Ohio Hair-cap (e) is elongated, slender with a tapering neck, and with a much longer beak to the lid. The lid and the calyptra of the Ohio Hair-cap fall early in June, very soon after the spores are ripe, and it is not always easy to find either in position, but if the calyptra be found, it will be seen to cover the upper portion of the capsule only. The Common Hair-cap, although occurring in woods, is most common in open fields; the Ohio Hair-cap being

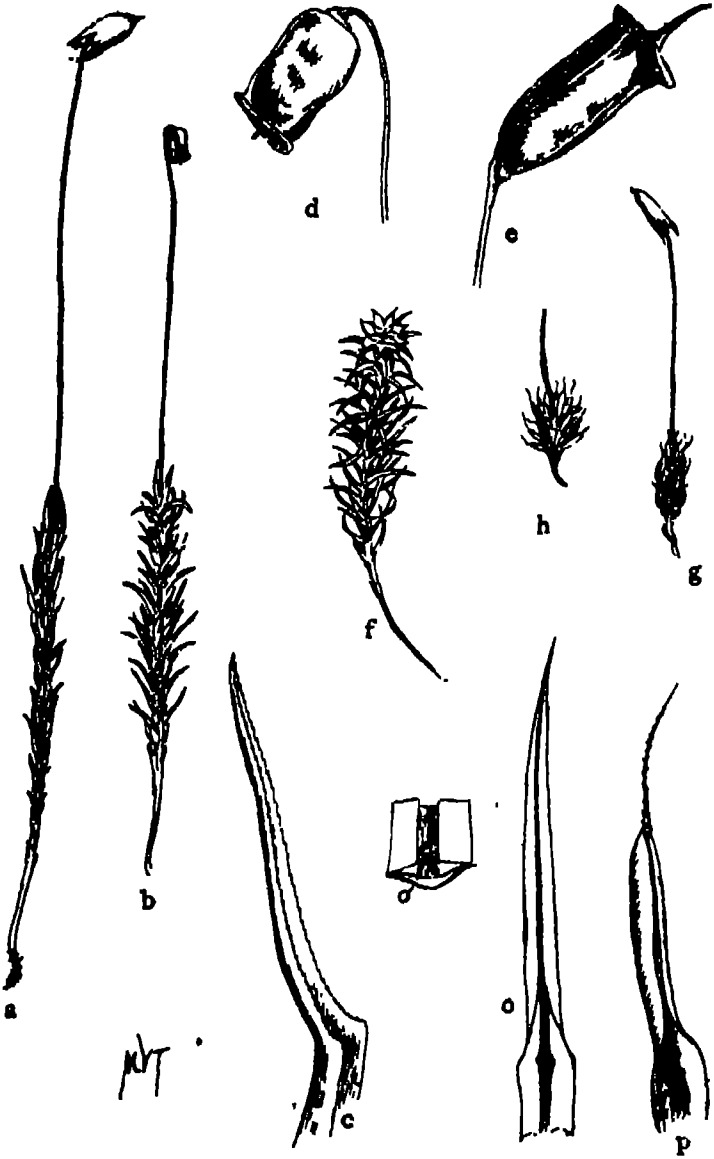


Plate II, Polytrichum or Hair-cap Moss
Figs a (dry), b (moist), c (leaf), d (capsule) and f are P commune,
Fig e, capsule of P ohioense,
Figs g, h and p, P piliferum,
Figs. o and o', P juniperinum.

most frequent in shady, more moist spots, often in deep woods The remaining two species are easily distinguished from the two mentioned above by the margins of the leaves which are thin and membranaceous and are folded in over the central portion of the leaf, as illustrated in o o' and p "

I can not too strongly commend "Mosses with a Hand-Lens" (price $1 10) prepared with the purpose of giving ' by drawings and descriptions the information necessary to enable any one interested to become acquainted with the more common mosses with the least possible outlay of time, patience and money " The book contains a key to the genera based mainly on structural characters and one mainly on habitat, also many keys under the genera, copious illustrations, clear and accurate on almost every page of the text and eight full-page plates from drawings by Mary V Thayer, and an illustrated glossary of bryological terms

MEETING OF THE BIOLOGICAL CLUB

The Biological Club met in Zoological lecture room December 8, 1900 Prof Herbert Osborn presided twenty-six members present The following papers were presented

" Notes on the Saw Brier and a Rhamnus new to Ohio '

" The Waverly Series of Ohio "

In the first paper Prof Kellerman spoke of the distribution of the Saw-Brier *Smilax glauca* in the southern part of the State, and exhibited specimens showing its striking variations in form of leaves,

The southern buckthorne *Rhamnus caroliniana*, was observed commonly in Adams County It also occurs in Brown County This is the first record for this species in Ohio Specimens in fruit were exhibited

A hackberry was found unlike any form hitherto reported from Ohio Specimens are in the hands of Rev E J Hill for study and determination

Prof Ball reported leaf variation as occurring commonly in Colorado and that various leaf forms could be observed in climbing a single hill

Prof Prosser, in the second paper, reviewed the literature that has been published on the Waverly Series of Ohio, and as a summing up gave a list of names with authorities to be used in future in speaking of the formations of this series These are as follows·

Beginning above the Huron Shale 1 Bedford Shale (Newb) 85 feet 2 Berea Grit (Newb) 40 feet 3 Sunbury Shale (Hicks) 10-15 feet 4 Cuyahoga Shale (Newb) 275-300 feet 5 Black Hand Conglomerate (Hicks) 40-100 feet 6 Logan Sandstone (Andrews) 115 feet

Under the head of personal observations, Prof Schaffner gave a list of trees and shrubs which he and F J Tyler had found cutting off (self-pruning) their own branches

Prof Kellerman remarked upon the abundance of the red-seeded dandelion in various parts of the state

Walter Metz, J A Beer, H A Clark Charles I Meade, Miss Elizabeth Sessions, Miss L D Wilson W P Simpson, Mrs J H Schaffner, B B Wells, Mrs E D Ball, J N Frank, A G McCall, Miss Carrie R Weick, A C Whitmore, Miss Caroline Meade and Miss Maud Flynn were elected to membership

Professors Prosser, Landacre and Mr. Griggs were appointed a committee to locate board and lodging for members of the Ohio Academy of Science Adjourned JAS S HINE, Secretary.

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PERENNIAL TUMBLEWEEDS.

JOHN H. SCHAFFNER.

Tumbleweeds may be classified under three general heads:

- Annual tumbleweeds,
- Tumble-grasses,
- Perennial tumbleweeds.

The annual tumbleweeds are mostly plants with a small root system which shrivels up or rots away soon after the seed has matured The plants are then easily torn from the ground or broken off and go tumbling away before the wind. In some cases the roots become quite fleshy and brittle In the tumble-grasses the panicle is generally the only part which is transported, the stems of the panicle being usually very brittle and breaking readily even in those forms which are easily torn up from the roots.

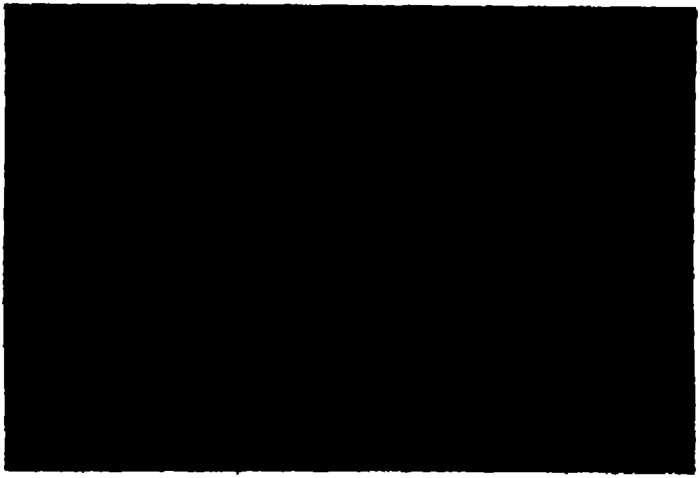


Fig 1 Psoralea floribunda Plant growing on prairie, Clay Co., Kan

Fig 2 Plant of P floribunda showing a part of the deep taproot

The perennial tumbleweeds are especially interesting because of the way in which they are separated from the underground parts Among the perennial forms Psoralea floribunda is one of the most typical It is a longlived, perennial crown-former with a very deep root which may be several inches in diameter From the short terminal stem of this root a number of aerial branches are developed annually These branches take on a more or less globose or balloon-shaped form At the base of each aerial stem a number of special joints are formed in which transverse cleavage regions are gradually developed and when the seed is ripe the whole crown breaks off at these joints with remarkable ease This is a peculiar case of the development of a self-pruning process in the stem for a very special purpose

Psoralea argophylla also develops perfect joints but fewer shoots usually make up the crown and it is therefore less conspicuous than P floribunda Psoralea esculenta is also a tumbleweed but the writer has not made an examination of the way in which it separates from the thick, tuberous, perennial root.

Psoralea floribunda is very abundant in north-central Kansas where the writer has seen great masses heaped up against hedgerows and wire fences These plants show a most remarkable responsive adaption to an environment of very definite conditions They have developed nearly every character possible in harmony with the dry and windy plains of the west and may be regarded as ideal prairie plants

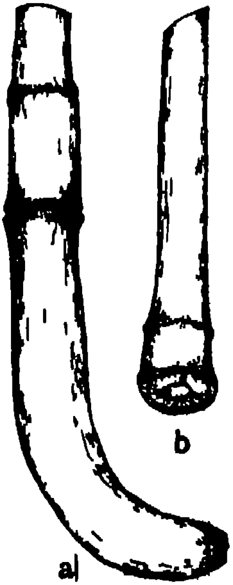


Fig 3 (a) Base of a stem of P floribunda with two cleavage joints (b) Base of stem showing cleavage surface

THE SPROUTING OF COCKLEBUR SEEDS.

E. E. Masterman.

In July, 1896, Dr. E. W. Claypole, then of Buchtel College, Akron, Ohio, asked me how general was the belief that one seed of the cocklebur grew one year and the other the next year or later. Inquiry of about twenty of the older residents resulted in procuring no information touching the same. In 1897, I was told by a German farmer that one seed only grew one year and the other later, never both at the same time. A short time after I noticed the statement of A D Selby in Bulletin 83, (page 353) Ohio Experiment Station, as follows: "Prof. Arthur has recently shown that only one of these seeds can be caused to germinate the first year, the other always remaining until the second year." This was a confirmation of the German's claim, yet I determind to investigate for myself.

I carried on the experiment for three years with the following results:

In 1898, I planted 1000 burs; 917 grew two plants to the bur.
In 1899, I planted 1000 burs; 921 grew two plants to the bur.
In 1900, I planted 1000 burs, 913 grew two plants to the bur.
Total three years, 3000 burs; 2751 grew two plants to the bur.

Of the remaining 249 burs some grew one plant, some none; some had one, some had two apparently sound seeds. I regret that no further notice was taken of these seeds. The *only* object was to determine whether the two seeds *could* be made to grow at the same time. An account of the work was sent to Professor Selby, asking whether further experiment was necessary; he replied that he thought not.

Perhaps it should be added that I selected only apparently sound burs; soil was taken from a field near a creek where cockleburs grow abundantly. It was passed through a ¼ inch-mesh wire sieve, and carefully searched over with the aid of a glass. This soil was taken to a distant part of the farm; in it the seeds were planted and nature did the rest.

I also made observations as follows: I searched among specimens growing for a mile along a creek, for two plants growing together and not nearer than five inches to any other plant. Of the 1500 specimens examined each year for three years, two plants always grew from one bur.

Why have I obtained such opposite results as compared with Professor Arthur's? Can it be referred to locality, soil, or some other more favorable conditions?

The substance of the above was presented, December 27, 1900, to the Ohio Academy of Science and it provoked a discussion in which Professors Kellerman, Schaffner, Mosely and others participated. Dr. Kellerman thought that the results of Arthur's experiments were perhaps more nearly in accord with what usually takes place in nature. He pointed out the mistake of quoting or saying that Arthur has shown "that only one of the seeds can be caused to germinate the first year." Turning to the printed report of the experiments in question (Proc. 16th, An Meeting Soc Prom. Agr. Sci, 1895), I find that, based on many experiments made previous to 1895, he gives the result in round numbers as follows: "Out of every hundred ordinarily well formed cockleburs, seventy will produce one seedling each, and five two seedlings each the first year after maturity; the remaining twenty-five will for various reasons fail to grow. Thirty of the hundred will produce seedlings the second year after maturity, five will produce seedlings the third year after maturity, and two or three seedlings will be produced in subsequent years.

Later experiments by Dr Arthur seemed to show a lower percentage of cases of the sprouting of both seeds to the bur in one season In the summary he states· "The germination of both seeds of a bur of Xanthium in one season is exceptional."

In view of the above and in accordance with the suggestions of others I purpose continuing my experiments relative to this subject.

The following interesting statement is made by Dr. Arthur, in the report cited, touching the cause of the difference in the action of the two seeds; he says it "appears to be constitutional; a hereditary character residing in the protoplasm of the embryo."

New London, Ohio.

PLANT REMAINS FROM THE BAUM VILLAGE SITE.

W. C. MILLS.

During the year 1900 the Ohio Archaeological and Historical Society procured from the ash pits of the Baum Village Site, situated near Bournville, Ross county, Ohio, a number of grains and seeds, which were submitted to Prof. J. H. Schaffner for identification. The following is the list:

Corn, Zea mays L.

Great quanities of the eight rowed variety were found. The cobs were usually about one-half inch in diameter. Also a variety with more than eight rows, usually ten rows was found. This variety had a much thicker cob. The grains and cob were in a good state of preservation, having been charred. In several instances the charred remains of a woven fabric were found intermingled with the cobs and grains, showing that the corn had evidently been wrapped in this cloth. In other instances the grains and cobs were found in large pieces of broken pottery and were well preserved. Finding the corn in so many of the pits shows that it largely supplied the food of the camp.

Quantities of charred papaw seeds, Asimina triloba, (L.) Dunal, and the wild Hazelnut, Corylus americana Walt. were found in a number of pits showing that these were largely used for food.

Quite a quantity of the seeds of the wild red plum, Prunus americana Marsh was also taken from the pits. These were, in a number of instances, associated with papaw seeds and the shells of the chestnut, Castanea dentata (Marsh.) Borkh

Great quantities of the broken shells of the butternut, Juglans cinerea L. and the black walnut, Juglans nigra L were discovered. These were usually found associated together, but in several instances they were found separated, the butternuts being more abundant than the walnuts

Three species of hickory nuts were procured but none of these were in such quantities as the butternut and black walnut. The three species found were as follows Hicoria minima (Marsh.) Britt., Hicoria ovata (Mill) Britt., Hicoria laciniosa (Mx) Britt.

Several specimens of beans, Phaseolus (sp) and also a specimen of the grape, Vitis (sp.) were found in the material, but it was not possible to tell whether the beans were one of our wild species or cultivated

SPROUTING FLOWER BUDS OF OPUNTIA.

DR. V. STERKI.

In June of last year I took some Opuntia plants home, and also some top joints heavily set with large buds. The former were planted in the garden, the latter set in an Oleander tub. When, after a month, none of the flower buds had opened, it was thought that they were too many, as the joints bearing them were without roots, and most of them were cut off and left lying on the ground, where a part of them later on became partly or entirely covered with soil. In September, I was surprised to find them all green and fresh; most of them had rooted, and a few even sprouted, sending up shoots from half an inch to over an inch high, being perfect little joints. At the present writing (Jan. a. c.) all are alive, and, no doubt, will grow out to plants next summer. They will be watched closely and further report be given.

It might be added that the Opuntia calyx-tube, which is later the fruit, has "eyes," that is buds, of the same character as the ordinary buds of the plant, with clusters of bristles; and out of these the young shoots grew, when the bud took root.

Evidently these buds retain more of the nature of the mother plant than is common in flowers. It is unknown to me whether similar observations have been made before. But it would be of interest to make experiments with different plants. Would the receptacles root and sprout if detached after flowering and fertilisation have taken place? Would the buds sprout when left in situ on the mother plant, after the flowering parts had been removed, the receptacle only left in place? Will the buds of other genera of Cacteae, and other similar succulent plants behave in the same way, under favorable conditions?

So-called viviparous plants are, as is well known, rather common, e. g. among Gramineae, Cyperaceae, Polygoneae. But there the actual flower parts develop into leaves, from which they had originally been derived, and while yet remaining on the parent plant.

New Philadelphia, Ohio.

NOTE ON THE INVOLUCRAL LEAVES OF SYNDESMON.

F. H. Burglehaus.

Syndesmon thalictroides is described in Britton & Brown's Flora as having sessile involucral leaves, which character is contradicted in the plants growing in the vicinity of Toledo. Careful observation during the past season fails to reveal a single instance of sessile involucral leaves, and most of the specimens examined have these leaves borne on petioles from one-fourth to one-half inch in length. Should like to hear from others concerning this feature of one of our most beautiful and dainty spring flowers.

Toledo, Ohio.

COMPETITION IN BOTANY FOR OHIO SCHOOLS.

W. A. Kellerman.

Whatever may contribute to a more direct and real study of the plant kingdom on the part of the pupils can well be encouraged by the teacher. It is an unfortunate fact that in reference to a course in botany the notion largely prevails that it consists of lesson-work with a text-book like a course in history or algebra. It is often more dreaded than the latter because of the supposed necessity of learning a long list of difficult technical terms. Few teachers would be willing to give up the use of the text-book entirely and it is not at all necessary that they should. But every teacher can now choose a modern book of botany from the fairly long list that is offered by American publishers. These are not mainly terminology nor written with the chief aim of enabling the pupil, after having gone through a sufficient number of chapters, to "analyse" flowers.

Many of them unfortunately provide no means of identifying the native plants as a part of a school course, but teachers are not left without choice of a good book after such ultra ones are thrown out of the list.

The text of an elementary book on botany should contain the important facts and principles of the science, and give a brief but comprehensive idea of the plant kingdom, in simple and plain language. An intimation and partial elucidation of means and methods employed to test or to verify the principles and inferences should be evident in the text. But this of itself is not sufficient for pedagogical purposes; there should be besides practical work provided, regular in time, ample in amount, that may train in the exercise of observation, experimentation and judgment.

I have for years devoted one-half the time of the botanical courses, both elementary and advanced, to such real work carried on partly in the labratory, partly in the field. Besides courses here referred to others devoted wholly to laboratory, experimental or observational work are provided; but it is not my purpose to discuss these now. Neither is it necessary to give here a detailed outline of the practical work that should constitute a substantial portion of the elementary work for beginners. Those who wish to use such a simple yet ample course in the public schools can consult the "Practical Studies in Elementary Botany" published by Eldredge & Bro., Philadelphia, Pa.

But I desire to say in this connection that more real work on the native flora than is attempted even by able and enthusiastic teachers in Ohio schools would undoubtedly be advisable I have outlined some competition work and submitted it to some of the schools looking to more interest in elementary practical work in this science. It has been urged that the project might be made more widely known to our Ohio schools with possible advantage, and therefore I have furnished, though with some misgivings, the following statement of this scheme

Either of the following subjects may be selected: Mosses, Lichens, or Trees; the work to conform to the suggestions and directions given below. The Report of the work must be completed on or before May 15, 1901, and submitted to the Teacher of Botany, or person (or persons) designated by him, who—taking into account both the quality and quantity of the work—will forward, if worthy, the best report accompanied by the illustrative material, to the undersigned; whereupon the latter will, on or before May 31, send as a reward to the author of said report a copy of the OHIO NATURALIST VOL. 1.

Pupils now studying, or those who have formerly studied, botany are eligible to enter the competition. No award will be made unless at least two or three pupils undertake the work; it is hoped that every member of the class will compete.

It is desired that the pupils consult teachers, parents, and others, who may be able to advise as to the subject, kind and extent of the work, also as to the best arrangement and wording of the report, and the labelling and preparation of the accompanying illustrative material.

The report is to contain a detailed account of the work actually done by the pupil and in no case to contain anything not his own.

The names of those entering the competition must be sent to the undersigned on or before March 30th. The suggestions, directions and explanation of the three subjects proposed are as follows:

BRYOLOGICAL.—All the kinds of Mosses in the region should be collected and put under slight pressure till dry; then a small portion should be glued directly upon a piece of card-board and a larger amount placed in a paper pocket and attached to the same piece; the notes and drawings can also be attached to the same card-board which for each species should be 8½ x 11½ inches. Most of the kinds (species) can be found in fruit; the latter is a capsule (little pod) on a slender stem called the seta. Specimens without fruit are not very satisfactory.

Tell in each case on what the specimen grows as the ground, tree trunk, old log, rock, boulder, etc ; add other notes relating to its situation (habitat), abundance, appearance, general character (habit), etc.

Draw an enlarged figure at least of the capsule (fruit) of some or all of the species (kinds) collected. In the early stage there is usually a cap (called calyptra) on the capsule. When the capsule is ripe it opens by a lid (called the operculum) for the escape of the spores Notice the teeth (called collectively the peristome) surrounding the mouth of the capsule—evident when the operculum falls off

A good pocket lens must be used for this work The drawings must be clear; after completed with a sharp lead pencil it would be well to retrace with a fine pen and India (or drawing) ink. Excessive shading of the figures is objectionable.

If a book is desired, a suitable one for beginners is Grout's "Mosses with a Hand-lens," price $1.10; orders sent to the author or to the writer of this article will be promptly attended to. But for the purposes of this competition the botanical names of mosses are not *required;* it will be of course more interesting if an attempt at the identification of the species is in all cases made.

LICHENOLOGICAL.—All the kinds of Lichens in the region should be collected. The little disks, or saucer-like bodies, on the plants are the fruit (called the apothecium); the apothecia are more distinct and striking in appearance, as is the whole plant also, when moist; therefore the best time to collect lichens is after a prolonged rain, or when the air is moist; when dry they are usually brittle and cannot be satisfactorily handled.

Do not save specimens that have no fruit, except in case of rare species. Only enough pressure on the specimens (placed between blotters or soft papers) should be brought into requisition as is necessary to keep them from curving or crumpling while drying. Then glue a specimen to a card-board, 8½ x 11½ inches, and also attach a paper pocket containing ample material, and the drawings (if any are attempted), also the notes, to the same piece of card-board. Use a separate card-board for each kind (species).

Tell the substratum on which the specimen was found—as boulders, limestone, sandstone, log or stump, fence-rail, tree or plant, soil, etc. Give additional notes as to appearance, size, abundance, habitat, habit, etc. Those growing on rocks can not generally be removed—a thin piece of rock must be chipped off to secure them.

A detailed description should be written of each kind (species); drawings perhaps might be undertaken; the different species should be compared and contrasted. Use a good pocket-lens There is no text-books on Lichens that is usable by beginners.

DENDROLOGICAL.—The Trees may be studied from one of several points of view. If a camera be used, selected trees should be studied and illustrated; the bark compared in case of different species, likewise in case of one and the same species when the individuals are of different ages and sizes or grow in different situations or exposures; also modes of branching compared and shapes contrasted. Very full notes should be taken, and when written up in the report reference should be made constantly to the numbered illustrations. Few or many kinds of trees as preferred, may be taken if this phase of the subject is selected.

Instead of the above one may study and identify all the kinds (species) of trees in the region. Full descriptions should be written out, and similarities and contrasts of different species noted. Give uses of the kinds of woods only when such use is made in the region or the near town or city. Collect twigs and fasten them to card-boards (8½ x 11½ inches). Attach a specimen of the fruit also when it can be found under the tree. A pamphlet (price 10 cents) with a Key to the Ohio Forest Trees by means of which the names can be determined, may be obtained from the writer.

A third method of carrying out the work on trees would be to give an account of the forest area in the region—either taking a square or rectangular tract of a mile or more in extent; or selecting if possible a natural area, as a river or creek valley, or other obviously bounded tract of ample dimensions. Draw a map of the selected region and locate thereon the forests and groups of trees. Describe them, indicating the prominent kinds of trees, the less abundant species, and the very rare ones. Tell approximately the size of the largest, the commonest size, etc. Note uses made of some of the kinds in the region or at a near manufactory. Record other observations.

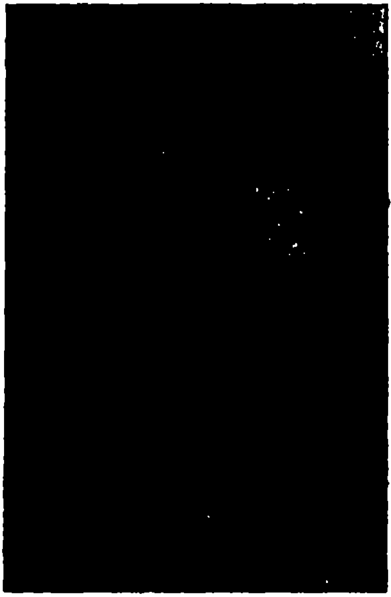
MINOR PLANT NOTES, NO. 2.

W. A. KELLERMAN.

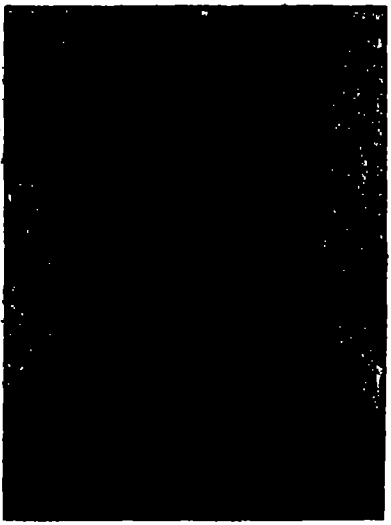
TARAXACUM ERYTHROSPERMUM.—The Red-seeded Dandelion, now known to be common in our State, is a late bloomer. An abundance of flowers may be seen way after the severe frosts of autumn set in. Mr. Fred J. Tyler collected specimens in bloom at Perry, Lake County, December 17. He reports "great fields" of it at that place, whereas the common Dandelion (Taraxacum taraxacum) was conspicuous by its absence. Prof. Beardslee of Cleveland, reports the Red-seeded form as the one of common occurrence in Cuyahoga County I have noted the Red-seeded form in bloom near the city of Columbus December 28, though the month has been a cold one, the thermometer registering once 10° F. The Common Dandelion (Taraxacum taraxacum) does not seem to bloom so late in the season—at least it is in bloom much less abundantly here Contributions of phenological observations on interesting plants of our flora by readers of THE NATURALIST are in this incidental way earnestly solicited.

GROVE OF LARGE BEECHES.—There are now remaining in Ohio very few large groves of beeches. Of groves of very large beeches the same may be said. At Arion, in Scioto County, in the narrow valley of Brush Creek, are a large number of magnificent specimens of this very attractive American tree. The trunks are straight as is always the case for this species, smooth, and many of them are ten to twelve feet in circumference. One specimen measured twelve feet four inches, three feet from the ground. The grove is now used for picnic and camping purposes, and it is sincerely hoped that these splendid trees may be sacredly preserved for an indefinite time.

HABITAT OF RHAMNUS CAROLINIANA.—The manuals give the habitat of this species "in swamps and on low grounds" (Britton), "swamps and river banks" (Gray), "river banks" (Wood), and "fertile soil" (Chapman)., It has been previously reported that this species was found in Ohio last November. Several specimens were found near the Ohio river in Adams county at the mouth of Brush creek, and a few were seen in Brown county. In a little ravine on Cedar creek, a tributary of Brush creek, in Adams county, fourteen miles north of the Ohio river, an enormous number of plants were growing. Some were nine to eleven inches in circumference at the base and fourteen feet high. None occurred in "swamps," though many were in "low grounds" where the soil seemed to be fairly fertile. The majority were on rocky hillsides or quite on the top of very high ground. The annexed cut shows a specimen near the top of a rocky bluff or hill perhaps one hundred and fifty feet above the valley at Cedar Mills, Ohio. This southern Buckthorn still retained its shining leaves though my visit was late in November when nearly all the other trees except the oaks were bare. This, with the great quantities of black fruits, presented a charming spectacle. The plant is also reported in Stanley Coulter's catalogue of Indiana plants, discovered in the southern counties by Mr. W. T. Blatchley, "growing on rocky hillsides."



Rhamnus Caroliniana on a rocky hill



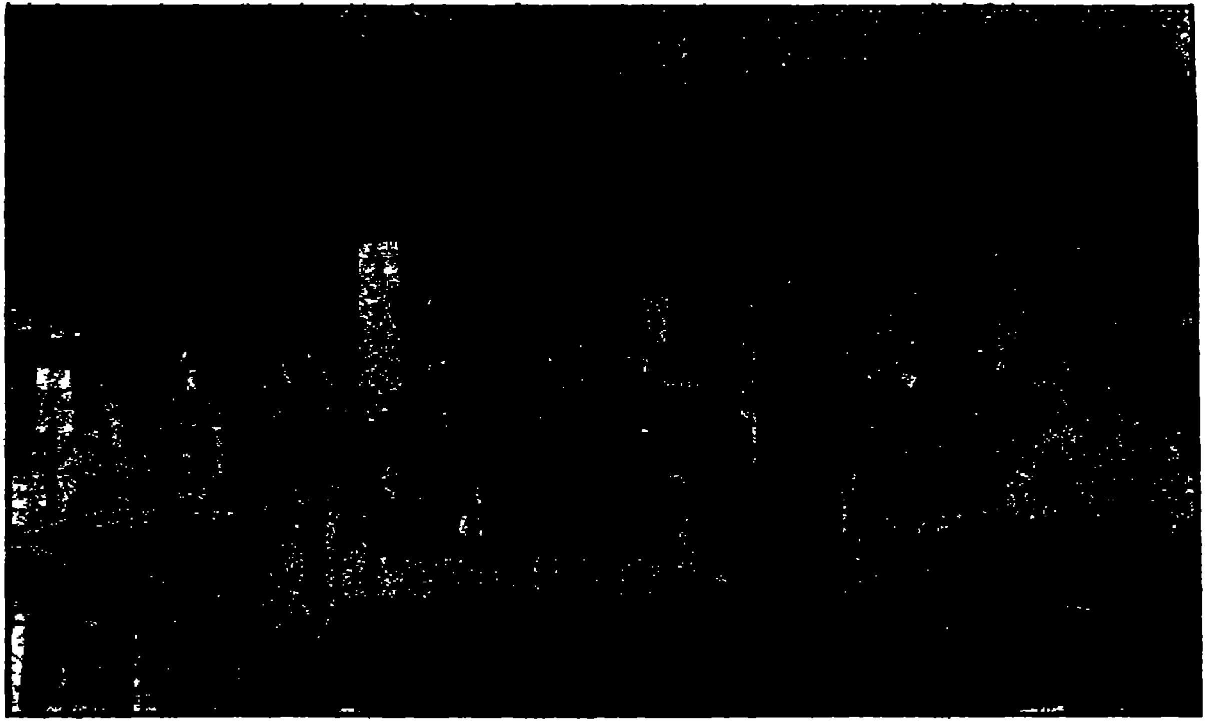
Twin Beech and Red Oak

Twin Trees; Two Species.—Sometimes two trees attempt to occupy the same space at the same time. The cut above shows a red oak and a beech in close juxtaposition, neither having been able to crowd the other out, and the two are united for a short distance from the ground. This would hardly be called a natural graft perhaps, though the two are intimately united. The trees are vigorous typical specimens of the two species, growing near Brush creek, at Arion, in Scioto county, Ohio. Several other examples in the same region were noticed. Sometimes the two trees are the same species, but usually of different species, the union of tissue in all cases equally evident.

and its capacity will doubtless be increased as necessity requires. It is a two-story frame building 22 x 66 feet, the upper floor of which is used for investigation and the lower in part for students' laboratory tables. It is supplied with city water, a number of aquaria, has a convenient dark room for photographic work, and answers admirably for the purpose for which it is used—that is, for a temporary summer laboratory. The laboratory is supplied with two boats equipped with sails, and designed especially for work in the bay and marshes. Dredges, seines, plankton net and other collecting apparatus are provided, while microscopes, microtomes, books, and other laboratory equipments are taken from the university

PART OF LABORATORY ROOM, LOWER FLOOR.

While under the management of the Ohio State University, it is desired to make the laboratory as useful as possible to instructors and investigators in biology, wherever located. To this end table



LABORATORY ROOMS OF UPPER FLOOR.

room is granted free of charge to qualified investigators, and any one wishing to undertake investigation of biological problems will be given all possible opportunity. Courses of study have been designed especially for high school teachers and for advanced university students, the former devoting themselves to methods of field work and preservation of material for laboratory use, and acquiring methods of laboratory work in connection with study of typical forms. For the latter, advanced courses in embryology, morphology, entomology, plant ecology, botany, etc., are offered. The students taking such courses can secure for them university credits covering equivalent courses in the university curriculum. It is needless to say that the opportunities for field observation, collecting, and the laboratory study of representative forms are most favorable. For special advanced courses in embryology, and particularly those pertaining to microscopical technique, the more elaborate equipment of the university is of course preferable.

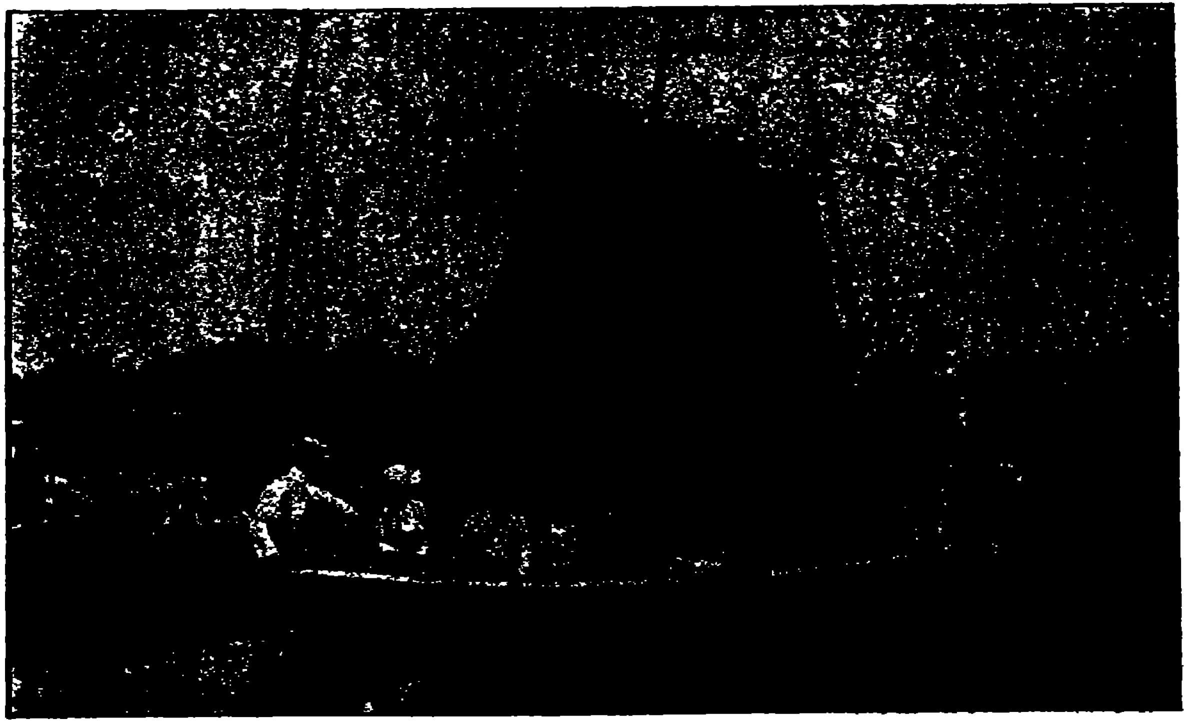
NOTES ON THE FLORA OF SANDUSKY.

W. A. KELLERMAN

The visitor or student at the Lake Laboratory will find in the neighborhood of Sandusky a flora in many respects peculiar and richer in species perhaps than in any other region of similar area in the state of Ohio. For our knowledge of the Sandusky plants we are indebted mainly to the continued and energetic explorations of E. L Moseley, teacher of botany in the Sandusky High School. Our visits to the region have been numerous, and many weeks have been spent in herborizing during the last few seasons. Mr Moseley's Sandusky Flora (Ohio State Academy of Science, Special Papers No. 1) and additions by myself and Mr. Griggs reported before the Academy of Science, and published in THE OHIO NATURALIST, Vol. 1, fully represent our knowledge of this interesting flora to date.

In the 'Sandusky Flora," page 2, Mr. Moseley states that "the surpassing richness of the Sandusky flora is not due to the fact that it includes islands within its territory, for scarcely any of its species are confined to the islands, nor is it in a very large measure due to the fact that it includes species that are confined to the lake shore; but rather to peculiarities of climate and geological features, both of which depend to some extent on the proximity of the lake."

Space will allow reference to but few of the interesting and rarer plants. On Cedar Point and a few other places the Prickly pear, Opuntia humifusa, appears in great abundance, but is reported for no other stations in Ohio. The illustration (Fig 1) shows a patch of this plant, and also indicates the sparse vegetation in the open sandy



AT THE BOAT LANDING.

Black Oak woods of Cedar Point. Here we found three specimens of the rare Lea's Oak, one fine specimen of the common Juniper (Juniperus communis), two specimens of the Sand cherry (Prunus pumila), none of which are given in the "Sandusky Flora" for this place, and one only—the Juniper—for Catawba. Of other rare or specially interesting plants for this point the following may be mentioned: Ammophila arenaria, Panicum virgatum, Salix glaucophylla, Salix sericea, Euphorbia polygonifolia, Pinus strobus, Stipa spartea, Chenopodium leptophyllum, Lepargyraea canadensis, Œnothera rhombipetala, Artemisia caudata, Arctostaphylos uva-ursi, Symphoricarpus pauciflorus, Utricularia gibba and Lacinaria scariosa.

By no means the least interesting vegetation on Cedar Point are the dune plants, many species of arenophilous species, and efficient soil binders. Some idea of the appearance of a few of such plants may be gained from the cut (Fig. 2), which shows one of the sand hills held exclusively by the roots of the Red Cedar. Other similar hillocks are held by one of the wild grape vines, Vitis vulpina. and many other plants The tufts of some of the grasses, especially Panicum virgatum, can be seen in the same illustration.

At Marblehead and Catawba the flora is equally rich in local and interesting plants. Huge Buckeyes occur, one of which measures nine feet and two inches in circumference. The Red Oaks are numerous and remarkably variable in their fruits. There occurs Zygadenus elegans and Kœleria cristata, Meibomia illonoensis, Solanum rostratum, and Picradenia acaulis—all western species. The Lakeside Daisy, as the Picradenia has been locally named, is especially attractive. It occurs in one place in Illinois, but otherwise known only far west of the Mississippi river.

Elsewhere, and especially in the prairie region of Erie county, there occur such rare species as Aletris fainosa, Aristida gracilis and A. purpurascens, Salix candida, Prunus cuneata, Psoralea pedunculata, Rhexia virginica, Eryngium yuccifolium, Asclepias obtusifolia and A sullivantii, and Helianthus mollis.

The bay is even richer, presenting acres and acres of Nelumbo, Sagittaria, Potamogetons, Rushes, Reeds, Duckweeds, Polygonum, Ceratophyllum, and others too numerous to mention The innumerable and unenumerated Algae must not go unmentioned—here, as in many other lines, the enthusiastic students will reap a rich harvest.

FIG 1.—PRICKLY PEAR IN WOODS OF BLACK OAK, CEDAR POINT.

FIG. 2.—SAND HELD BY THE ROOTS OF RED CEDAR.

KELLERMAN ON PLANTS OF CEDAR POINT.

ZOOLOGICAL NOTES.

HERBERT OSBORN.

Cedar Point offers a number of rather peculiar features for study, and the fauna of the locality presents a very attractive field. On the one hand there is an extensive beach some six or seven miles in length, from which the sand dune formation extends backwards and merges into a swampy area bordering the waters of Sandusky Bay. On the beach after every storm will be found a large mass of drift material, including numerous fishes that have been thrown ashore. These furnish an attraction for a number of forms of animals, a complete census of which has as yet not been attempted. It may be mentioned, however, that numerous species of flies take to them to deposit their eggs, the larvae a few days after each storm being a conspicuous element to be followed a few days later by pupae or mature flies; these in turn attract various birds and large numbers of toads, which seem to secure a very constant source of food especially in this vicinity. Species of burrowing Hymenoptera are conspicuous and upon the sand dunes the grass hopper (*Trimeropitropis maritima*) is especially abundant. A millipede (*Fontaria indianae*) is also very abundant crawling over the sand, and turtles from the lake pass up the beach and over the dunes to deposit their eggs at favorable points.

FIG 1 — A BIT OF CEDAR POINT BEACH.

FOOT PRINTS.—A study of the tracks and foot prints which are made in the sand is especially interesting, and the determination of species which are responsible for particular kinds of tracks is a fascinating though somewhat complicated study. Several of these have been identified with certainty, and a brief description of them in connection with a reproduction of some photographs may be of interest. Toad tracks are numerous and quite conspicuous and consist of four slight imprints in the sand, these occurring with regularity in length corresponding with the length of the leap and the tracks, with the distance between them, corresponding with the size of the

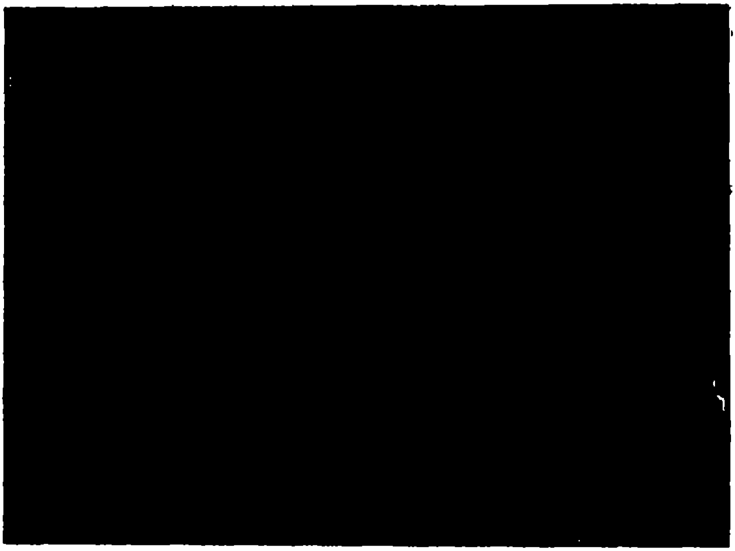


FIG 2.—FOOTPRINTS OF TOAD, GRASS-HOPPER AND MILLIPEDE.
Photo by H Osborn

individual. These are shown in Figure 2, between the points marked X. The abundant grass-hopper, described more fully in another paragraph, produces when walking a continuous series of fine imprints in two or three more or less distinct lines on either side, midway between which is a narrow groove formed by the dragging of the abdomen. These tracks begin and end abruptly in case the insect is alarmed and leaps into the air. Several of these lines of imprint are shown in the figure—one distinct one above the point in Figure 2, marked +. Another very characteristic one that is easily referred to the millipede consists of parallel lines, in which the imprints of the individual feet are scarcely visible, and between which the sand is smoothed by the under surface of the body. In Fig. 2 under *a*.

ANT LION.—Still another very characteristic member of the dune fauna is the ant lion, the larvae of which construct their characteristic pitfalls in slightly protected places near bushes or trees, sometimes in great numbers, indicating a very numerous colony of these curious creatures. Of these there are, judging by the larvae, two quite distinct species common to the Point, but these have not as yet been reared. Aside from the pitfalls these ant lions make a peculiar track in the sand when they are moving from one point to another. These movements apparently occur only during short periods, as is shown when an area which has been entirely free from such tracks will be noticed after an hour or two to be completely netted with their devious furrows, which could only be formed by a number of larvae. The larvae move backward, and from the character of the furrows produced in the sand, must remain just beneath the surface of the sand, as the sand is raised on either side. That the furrows are formed by these larvae is proven by the fact that if the pitfalls at their ends be dug into they will be found to contain larvae. The movements of the larvae, forcibly pro-

FIG 3.—PITFALLS AND TRACKS OF ANT LIONS.

duced, make lines like those observed. Pitfalls and furrows are illustrated in the accompanying plates, the furrows being quite indistinct, as they are not deep enough to produce distinct shade, and consequently do not show conspicuously in the photograph. Furrows are to be noted, however, in the figure (No. 3) above the points marked X.

Fig 4.—Eagle Nest.

Photo by R F Griggs

Fig. 5.—Eagle Nest.

Photo by H Osborn

EAGLE NESTS.—The bald eagle nests at various points along the lake shore, and some of these nests were observed, and photographs secured during the past summer. One of these is between Sandusky and Huron, about two miles from Huron, and a half mile from the Huron street railway, in a Shag bark hickory tree. It stands away from other timber, although it is said formerly to have been surrounded entirely by trees. It is probably one hundred and twenty-five feet in height, or more, and doubtless towered above surrounding trees, and at present constitutes the most conspicuous object to be seen for miles in any direction. The nest, as shown in the accompanying photographs, must be at least a hundred feet from the ground, but owing to the impossibility of climbing the tree, and from the fact that no exact means of measurement were at hand, the precise height is unknown. This nest, we were told, has been in this tree only a few years, but prior to its building one has existed in the immediate locality for at least thirty years past. The nest is evidently five or six feet in diameter, being somewhat more flattened than other nests observed, owing probably to the spreading character of the limbs upon which it rests. No eagles were to be seen at the time of our visit to the tree, but we were informed by the proprietor of the farm that they had reared a brood during the season, and one was seen later by Mr. Griggs, at the time his photograph was taken.

Other nests occur on Kelly's Island, and we made a trip to that locality for the purpose of noting them and taking photographs, which, however, on account of the day being unfavorable, are not very clear, and cannot be reproduced to advantage They are about a mile and a half eastward from the steamboat landing, one occurring in a Maple tree about seventy-five feet in height, and the nest at a height of about sixty-five feet, being at least six feet in height, fitting the somewhat acute crotch, and at least five or six feet across the top. The other is in a Burr Oak tree, some distance from other trees, in a vineyard, and plainly to be seen from the lake steamers when to the southeast of the landing. The tree is about a hundred feet high, and the nest is about eighty or eighty-five feet from the ground. It is similar in form to the one just mentioned. Portions can be seen to contain very large branches, which show out conspicuously from the ground.

TRIMEROTROPIS MARITIMA.—This grasshopper which is very abundant on the dunes along Cedar Point Beach, is of special interest because of its protective resemblance to the sand on which it ordinarily rests. It is one of the best examples I have seen of adaptive coloration, but does not seem to have been mentioned in such connection, possibly because the colors change in preserved specimens so that the mimicry is totally lost. They reach maturity in latter part of June, and while only larvae are seen in middle of June, nearly all have matured by the latter part of July. They occur most abundantly on the sand adjacent to the clumps of grass upon which they doubtless feed, though so far no individuals have been observed actually feeding on grass leaves, but one was observed eating a fragment of apple cast up in drift materials on the beach. When disturbed they invariably alight on the sand, upon which they become at once invisible. About the only way to capture them is to throw a net down on a spot where one has been seen to alight, and then it not infrequently happens that two or even three will be caught though their presence has not been suspected.

The adult is whitish gray speckled with ferruginous fuscous and black, conspicuous ferruginous points occurring usually on the anterior margin of pronotum and on the lower borders of epimera of meso- and meta-thorax, humeri of elytra and discal carina of femur, these may be faint or obsolete, and on wings and legs may form slender lides; dark freckles occur on carinæ of vertex and face, forming a series back of collar on pronotum, on posterior border of pronotum and on sides of elytra and hind femora; on elytra they are thicker at three places, one-fourth, one-half and two-thirds from base, constituting fairly distinct patches, and on femur are two indistinct bands corresponding with well marked black bands on the inner side Anterior and middle femora and tibiæ nearly white, milky, with gray annulations; hind tibiæ gray at base, distal two-thirds yellow, in one form orange or reddish, spines yellow, tipped with black, anterior and middle tarsi ferruginous or reddish, hind tarsi yellow. The sternum is finely pilose. A variety is quite uniformly yellowish gray.

The larvae are similarly speckled but differ in that the dorsum of abdomen is densely speckled, while in adults this part protected by the folded wings is not speckled. In all these points a perfect adaptation to the color and markings that blend with the sand grains is evident

In the latter part of the summer of 1899, many of these grasshoppers died from an attack of parasitic fungus, and in such cases climbed up on stems of grass where their whitened bodies became very conspicuous. Eggs are doubtless laid in autumn probably in packed sand in grass clumps to hatch in following spring.

NOTES ON THE BIRD LIFE OF CEDAR POINT.

Robert F. Griggs.

Ecologically Cedar Point is an exceedingly interesting region. It is a narrow peninsula on one side of which flourishes a xerophytic dune flora, and on the other a luxuriant hydrophytic marsh flora. The meeting of these two gives the flora a very peculiar aspect.

Except at its tip Cedar Point has never been inhabited. It is still in very nearly its primitive condition. With a view to seeing how these and other factors peculiar to the region have influenced its bird life, these notes have been assembled. No pretentions to systematic completeness are made; the present purpose is more to determine the general character of the avifauna than to give a complete list including many accidental or occasional species which would overshadow the more characteristic residents. The observations upon which these notes are based were taken during the summer months (1900) when there were few species migrating, so that with the exceptions noted they include only the bulk of the summer residents at the Point. The birds of the marsh and bay are so inseparable from those of the point proper, that the commoner of them have been included, though no special study of them was made The following birds were observed:

Sterna hirundo Linn Common Tern, common.

Hydrochelidon nigra surinamensis (Gmel.). Black Tern, common, breeds.

Botaurus lentiginosus (Montag.). American Bittern, common.

Ardetta exilis (Gmel.) Least Bittern, common.

Ardea Herodias Linn. Great Blue Heron, common.

Gallinula galeata (Licht.). Florida Gallinule.

Fulica americana Gmel. Coot, common, breeds.

Ereunetes pusillus (Linn.). Semi-palmated Sandpiper. No specimens were taken to render identification sure—occurs in numbers on the beach

Symphemia semipalmata (Gmel.). Willet, a few individuals.

Aegialitis vocifera (Linn). Killdeer, common.

Zenaidura macroura (Linn.). Mourning Dove, not common, breeds.

Circus hudsonius (Linn.). Marsh Hawk.

Haliæetus leucocephalus (Linn.). Bald Eagle, nests near the foot of the Point.

Coccyzus americanus (Linn.). Yellow-billed Cuckoo, scarce.

Coccyzus erythropthalmus (Wils.). Black-billed Cuckoo, quite common.

Colaptes auratus (Linn.). Flicker. I do not understand why the woodpeckers should not be well represented. There appears to be abundant feeding ground for them; yet I saw only one solitary flicker, the least specialised of all the woodpeckers.

Trochilus colubris (Linn.). Ruby-throated Hummingbird, congregates in small flocks about the frequent clumps of trumpet creeper.

Tyrannus tyrannus (Linn.). Kingbird, breeds. This and the other fly-catchers are very abundant on account of the great number of insects occurring.

Myiarchus crinitus (Linn.). Crested Flycatcher, breeds.

Contopus virens (Linn.). Wood Pewee, very common.

Agelaius phœniceus (Linn.). Red-winged Blackbird, common.

Icterus galbula (Linn.). Baltimore Oriole, one small flock migrating.

Quiscalus quiscula æneus (Ridgw.). Crow Blackbird. This with the redwings and probably the other blackbirds congregates in very large flocks.

Melospiza fasciata (Gmel.). Song Sparrow, common.

Pipilo erythropthalmus (Linn.) Towhee.

Cardinalis cardinalis (Linn.). Cardinal, one pair.

Passerina cyanea (Linn) Indigo Bunting, very common.

Petrochelidon lunifrons (Say.). Eave Swallow.

Chelidon erythrogaster (Bodd.). Barn Swallow.

Clivicola riparia (Linn). Bank Swallow

The Swallows flock to the beach by thousands after a storm, but are not abundant at other times.

Ampelis cedrorum (Vieill.). Cedar Waxwing.

Dendroica aestiva (Gmel.). Yellow Warbler, common, breeds.

Icteria virens (Linn). Yellow-breasted Chat

Galeoscoptes carolinensis (Linn.). Catbird, common, breeds.

Cistothorus palustris (Wils.). Long-billed Marsh Wren, very common, breeds.

Parus atricapillus (Linn). Chickadee.

Merula migratoria (Linn.). American Robin, only one pair, seen only once.

Many birds common in most localities are conspicuous by their absence. The blue jay, crow, thrushes, most of the birds of prey, and the woodpeckers, and many of the sparrows, especially the ubiquitous English sparrow, were not observed at all. But the species occurring are present in great numbers, so that the region may be said to be monotonous in its bird life as well as in its other ecological relations.

PLANT STUDY AT SANDUSKY BAY.

Harriet G. Burr.

To one whose work has not included collecting and study in such surroundings as Sandusky Bay affords, the revelation of even a few days here is worth a great deal. The marshes about Sandusky, the rocky islands, the sand dunes at Cedar Point, the "prairie" in the direction of Castalia, all offer valuable work to the student of ecology.

But during the week spent at the Lake Laboratory last August it was in study of the water plants of the Bay that I found the greatest interest. The collecting is after a manner novel to the "land lubber." The collections, carried back to the Laboratory for study, have the fascination of the unusual, for represented among them are families more or less unfamiliar to general students.

A collecting trip for water-plants usually takes one across the Bay among the bulrushes and wild rice along Cedar Point. Here from the sides of the boat we look down into a wilderness of strange forms through the clear water. The curious eel-grass, with its perfect spirals, Myriophyllum and Chara, Philotria, Utricularia, and the Potamogetons spread out upon the surface among the lily-pads around us, are among the most conspicuous. A few minutes collecting here is productive of results quite out of proportion to the time spent. Many of these plants, at the time of my visit, had lifted themselves to the surface and bore their inflorescence above the water. Among these were some of the Potamogetons, Utricularia, Philotria, and others. A marigold looked strangely out of place on the surface of the water—it was the Bidens Beckii in bloom. The American Lotus lifted its head conspicuously above its lesser neighbors Some minute, light-colored, fluffy masses, floating far out in the Bay, we decided to be the pollen of the Vallisneria.

I have said nothing of the Algae; the most of my work at the Laboratory, however, was with these forms. Many kinds are common and many more may be obtained by seeking for them. These types of plant life, in beauty of form and importance of study rivaled by none, repay much time spent upon them.

The collecting and study of only a week here—a week, too, of recreation rather than of work—was but a suggestion of what might be done, though one which proved quite powerful. From our landing at Cedar Point was visible, for a long distance out, the bright pink of a Swamp Rose Mallow. It typified the week's work, it was a suggestion, too, of other strangers which might be lurking behind those trees and among those vines and undergrowth. We found that the suggestion was not a vain one, and in following it out we were never disappointed.

DRAGONFLIES OF SANDUSKY.

JAMES S. HINE.

As the dragonflies of Sandusky have been quite carefully collected for a number of years, it may be worth while to give the result in the form of a list with notes on some of the species.

Calopteryx maculata and Hetaerina americana have not been taken as commonly as in some places, for the locality does not furnish their most desirable surroundings.

The genus Lestes is represented by unguiculatus, uncatus, disjunctus, forcipatus, rectangularis, vigilax, inequalis and eurinus. Nearly all of these species are abundant and are mostly found among the grass at the edge of the marsh.

The genus *Argia* is represented by four species, putrida, violacea, sedula and apicalis. The first two are very numerous in individuals.

Nehalennia posita and irene; Enallagma civile, ebrium, carunculatum, aspersum, exsulans, geminatum, antennatum, signatum pollutum; Amphiagrion saucium and Ischnura verticalis have all been taken, usually near the water's edge.

The Gomphines are not represented by a great number of species. Gomphus vastus is exceedingly common, and fraternus, furcifer, exilis, spicatus and plagiatus have been taken. Dromogomphus spinosus is also common.

Epiaeschna heros and Æschna verticalis and constricta may occasionally be seen, especially about the time the sun sets, catching small insects for food. Anax junius is the most conspicuous species in the locality from May to September.

Macromia illinoiensis is a very common species. At certain times the males and females of this species may be found in numbers in quiet places among bushes, where they come to rest on the under side of branches, their bodies being at an angle of about thirty degrees with the branch. They are easily approached at such times, and two females and four males have been taken at a single sweep of the net.

Epicordulia princeps, Tetragoneuria cynosura, Tramea carolina and lacerata and Pantala flavescens are occasionally seen.

Neurocordulia yamaskanensis has only been taken once on Rattlesnake Island. It is a rare species, but one that is more common it the northern states.

The genus Libellula is represented by basalis, 4-maculata, semifasciata, pulchella and incesta; and Sympetrum by obtrusum, rubicundulum, vicinum, semicinctum and corruptum.

Pachydiplax longipennis, Plathemis lydia, mesothemis simplicicollis, Perithemis domitia, Leucorhinia intacta and Celethemis eponina and elisa are abundant, and with the members of the genus Libellula furnish a very large percentage of the dragonfly life of the Sandusky Marshes.

SPONGES AND BRYOZOANS OF SANDUSKY BAY.

F. L. LANDACRE.

The two small groups of fresh water sponges and Bryozoa received some attention at the Lake laboratory during the summer of 1900

All our fresh water sponges belong to one family, the *Spongillidae*, which has about seven genera. They differ from the marine sponges in two particulars. They form skeletons of silicon only, while marine sponges may form silicious or limy or spongin skeletons. The spongin skeleton is the one that gives the bath sponge its value.

They also form winter buds or statoblasts which carry the sponge over the winter and reproduce it again in the spring. This peculiar process was probably acquired on account of the changes in temperature and in amount of moisture to which animals living in fresh water streams are subjected. The sponge dies in the fall of the year and its skeleton of silicious spines or spicules can be found with no protoplasm. The character of the spines in the body of the sponge and those surrounding the statoblast differ greatly, and those around the statoblast are the main reliance in identifying sponges. So that if a statoblast is found the sponge from which it came can be determined, and on the other hand it is frequently very difficult to determine the species of a sponge if it has not yet formed its statoblast. The statoblast is a globular or disc-shaped, nitroginous cell, with a chimney-like opening where the protoplasm escapes in the spring. The adult sponge is non-sexual but the statoblasts give rise to ova and spermatozoa which unite and produce a new sponge. The statoblast is considered as the sexual generation.

Three species belonging to one of the seven genera were positively identified.

Spongilla fragilis, Leidy, a very common form was found on submerged rocks on the south side of the bay near the city in great abundance. Its yellow statoblasts are numerous and placed in layers near the base of the sponge on the rock to which it is attached.

Another species *Spongilla cinerea*, Carter, was found on floating timber. It is ashen gray in color.

A third species *Spongilla aspinosa*, Potts, was found in Black Channel and near the city on submerged rocks. Its color is green. Other species were found but not definitely determined.

The fresh water Polyozoa comprise a small group of animals resembling the sponges in the process of statoblast formation, but otherwise totally different. Their real relationship is not definitely known. They are among the most beautiful of our lower fresh water forms. The body is nearly always protected by a cyst from which the anterior end of the animal projects when undisturbed and into which it can be retracted. There is a larval form resembling that of the worms and several other invertebrate groups, and a marked metamorphosis to the adult form The statoblasts as in the sponges are of value in identification, and are formed on a strand of tissue connecting the base of the animal to its cyst The individuals or Polyps increase in number by budding.

Two species are quite common at Sandusky *Plumatella polymorpha* as its name indicates is quite variable in form. The variety *repens* was very common on the rocks on the south side of bay near city. Its vine-like appearance renders it easy to identify. The Polyps are borne on the ends of the branches. The vine-like cyst clings closely to its support. The second species *Pectinatella magnifica* was found in Black Channel on submerged fish nets. It has a large spherical gelatinous base frequently eight or ten inches in diameter, over which the colonies of polyps are distributed. The individuals in each colony are arranged in the form of an aster. These large colonies are striking in appearance. The larvae are quite numerous and are globular in shape, and swim quite freely when liberated from the parent colony. The statoblasts are found in the fall as in the sponges. The process of statoblast formation and of larval development were studied, but the budding of individuals to enlarge the colony was not followed. The statoblasts of these animals seem to need to be both dried and frozen before development will go on in the spring.

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ADDITIONS TO THE SANDUSKY FLORA.

ROBERT F. GRIGGS.

The following plants not given in the "Sandusky Flora" have been collected in Erie county. They are here given in order that those possessing a copy of Professor Moseley's excellent flora of the region may keep it up to date. The numbers refer to the pages of the Sandusky Flora, on which the additions should be made.

44. Avena sativa L. Common Oat, escaped. W. A. Kellerman.
61. *Wolffia brasiliensis Wedd. Brazil Wolffia Sandusky Bay, abundant at times. R. F. Griggs.
70. Populus balsamifera L. Tacmahac, abundant on some portions of Cedar Point. R. F. Griggs.
71. Salix fragilis L. Crack Willow, common. W. A. Kellerman and R. F. Griggs.

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*Previously reported as additions to State list See OHIO NATURALIST, 1 15-16

71. *Salix interior var. wheeleri Rowlee. Cedar Point. W. A. Kellerman and R. F. Griggs.
71. *Salix petiolaris var. gracilis And. Perkins twp. R. F. Griggs.
71. *Salix candida x cordata. Castalia. R. F. Griggs.
78. Quercus leana Nutt. (Q. imbucaria x velutina). Cedar Point, three trees. W. A. Kellerman and R. F. Griggs.
98. Crataegus sp. undetermined. Marble-head. W. A. Kellerman.
99. Prunus pumila L. Sand Cherry, two plants on Cedar Point. W. A. Kellerman and R. F. Griggs.
180. Convolvulus japonicus Thumb. Sandusky, escaped. R. F. Griggs.
156. Eupatorium maculatum L. Blue Hole, Castalia. Frederick Dunlap.
158. *Helianthus maximiliani Schrad. A single plant along L. S. & M. S. tracks. R. F. Griggs.
159. *Polymnia canadensis var. radiata Gray. Cedar Point, very abundant. R. F. Griggs.

MINOR PLANT NOTES, NO. 3.

W. A. KELLERMAN.

SORGHUM SMUT IN ADAMS COUNTY.—A small field of Sorghum near Mineral Springs Station, Adams County, Ohio, was observed last November to be badly infected with the grain smut of Sorghum, known to botanists as ustilago sorghi, or perhaps more correctly designated (according to G. P. Clintoh) as Cintractia sorghi-vulgaris. A careful inspection of the harvested stalks, still piled in the field, showed that fully twenty per cent. of the panicles or heads were infected. When there is infection by this smut, usually every grain in the panicle is smutted according to repeated observations in various localities. The field in question was very thickly planted to sorghum, the crop evidently being intended for stock feed. The only other locality reported in Ohio for this smut, so far as at present recalled, is Columbus, where however it *has occurred only upon* artificial infection. Broom corn also was here successfully infected. Sorghum is often cultivated, but not in large quantities in Ohio; a large acreage of broom corn is however annually planted. Request is hereby made for reports in case this smut is noticed in other localities in our State. The Head-smut of Sorghum, Ustilago reiliana, should also be reported if observed.

NOTES ON SOME RUSTS.—M. A. Carleton, of the United States Department of Agriculture, has published some observations and experiments on a few rusts that are of special interest, and may well be noted here. He has shown that the common and abundant Spurge Rust, occurring on very many species of Euphorbia (twelve of which are listed in the Ohio Flora) is able to propogate itself constantly through the germinating seed of its host, and therefore becomes in that way practically a perennial species. He remarks that "It is the only demonstrated example of this manner of propogation in the whole order of Uredineae. Actual cluster-cups may be seen in the hulled seeds of Euphorbia dentata. Seedlings kept under bell jars become rusted three months from the date of planting, showing all stages of the rust, while seeds disinfected with mercuric cloride produce no rusted plants."

OHIO HYBRID OAKS.—The Ohio Oaks have received as yet no critical study, though notes as to their variation have occasionally and indirectly got into print. It is often suggested that there may be numerous hybrid forms, though mere guesses are scarcely of any significance. Lea's Oak, which is now known to occur in Ohio at four stations, namely, Cincinnati (the original locality reported), Brownsville in Licking County (tree since cut down), Columbus (one specimen), and Cedar Point in Erie County, has been known for years. It has been generally referred to Quercus imbricaria and Quercus velutina for its parentage, though Mr. Fischer was of opinion that the Columbus specimen was a cross between Quercus rubra and Quercus imbricarica. It was a matter of much interest when Mr. A. D. Selby reported, at the December Meeting of the Ohio Academy of Science, that he observed a hybrid Oak, a single tree, growing at Lakeville, Holmes County. The parentage he refers to Quercus alba and questionably Quercus inbricaria. He reports it with pronounced aspect of Q alba "save in the elongated, short-lobed leaves which obviously approach those of Q. inbricaria." While certain resemblances to Q. acuminata may suggest themselves (were his words) this species has not been observed in the immediate region. No mature fruit was seen. We may perhaps venture to suggest that the evidence for its hybridity between the two species named—one an annual-fruited and the other a biennial-fruited species—is suspiciously slender, and it is hoped that mature fruit and further inspection may put the case beyond doubt.

ASPARAGUS RUST ABUNDANT ON YOUNG PLANTS.—An inspection of the two patches of Asparagus on the University farm unexpectedly showed a more general infection of the plants which were but one year old. The older plants grow in the narrow flood plain of a little stream that flows through the farm to the Olentangy; throughout this patch which is perhaps a dozen years old, the infection is quite general, though very few of the plants show a large amount of the Rust, and no perceptible damage to the crop has hitherto been reported. A year ago seed was sown on higher ground about twenty rods from the old patch. The soil is mainly clay with some loam, and has been cultivated and fairly well manured for many years. The ground slopes to the west and is well drained, though the lower portion is perhaps somewhat inclined to be moist. The plants made an excellent growth The infection throughout was general, quite a large percentage of the stalks at this season being very black from base to tip with the almost contiguous sori or blotches of Rust. Why these thrifty young plants should be so thoroughly infected, as compared with the older ones but a short distance away which have for several years harbored the Rust, though rather sparingly, is not clear to the observer.

A LIST OF KANSAS DESMIDS.

John H. Schaffner.

A few years ago Prof. Lorenzo N Johnson, of the University of Michigan, was at work on a monograph of the Desmids of North America, intending to make a comprehensive study of the American species, but his untimely death in the early part of the year 1897, prevented the fulfillment of this purpose. Some material which Prof. Johnson had received from Kansas proved very rich in species.

Thinking that a list of the determined Kansas species would make a valuable addition to the Kansas flora, I have obtained the following list of forty-seven species which was kindly furnished by Mrs. Johnson, of Evanston, Ill. I have verified the names, and arranged the genera in the order followed in Engler and Prantl. Very few localities were given in the card catalogue from which the list was taken, and only a few others could be added which were taken from Prof. Johnson's published articles.

Family Desmidiaceae.

Penium (Breb.) DeB.

1. P. margaritaceum (Ehrb.) Breb

Closterium Nitzsch.

2. C. acerosum (Schrank) Ehrb.
3. C areolatum Wood.
4. C. didymotocum Corda.
5. C. lanceolatum Kts.
6. C. leibleinii Kts.
7. C. lineatum Ehrb.
8 C. lunula (Muell.) Nitzsch., Topeka.
9. C. macilentum Breb.
10. C. rostratum Ehrb.
11. C. setaceum Ehrb.
12. C. tumidium Johnson, Burlington.

Pleurotaenium (Naeg.) Lund.

13. P. nodulosum (Breb.) DeB.
14. C. trabecula (Ehrb.) Naeg.

Cosmarium (Corda) Lund

15 C botrytis (Bory) Menegh
16 C conspersum Ralfs
17 C constrictum Delp
18 C contractum Kirch
19 C granatum Breb
20 C ornatum Ralfs
21 C porrectum Nordst Burlington
22 C portianum Arch
23 C rectangulare Grun
24 C gotlandicum Wittr Burlington perhaps the same as the preceding species
25 C subcrenatum Hantzsch
26 C sulcatum Nordst
27 C triplicatum Wolle

Pleurotaeniopsis Lund

28 P ovalis (Ralfs) Lund

Arthrodesmus Ehrb

29 A convergens Ehrb

Xanthidium Ehrb
(Holacanthum Lund)

30 X antilopaeum (Breb) Ktz

Staurastrum (Meyen) Lund

31 S arctiscon (Ehrb) Lund
32 S crenulatum (Naeg) Delp
33 S cuspidatum Breb
34 S echinatum Breb
35 S eustephanum (Ehrb) Ralfs
36 S polymorphum Breb
37 S subarcuatum Wolle

Euastrum (Ehrb) Ralfs

38 E binale (Turp) Ralfs
39 E verrucosum (Ehrb) Ralfs

Micrasterias Ag

40 M furcata Ag
41 M rotata (Grev) Ralfs
42 M radiosa (Ag) Ralfs
43 M truncata (Corda) Breb

Onychonema Wallich

44 O laeve Nordst

Sphaerozosma (Corda) Arch

45 S wallichii Jacobsen

Hyalotheca Kuetz

46 H dissiliens (Smith) Breb
47 H mucosa (Mert) Ehrb

MOSSES, ILLUSTRATIVE SAMPLES

W A KELLERMAN

[This article was prepared as a suggestion for the Ohio Schools, and is issued simultaneously as No 17 of the UNIVERSITY BULLETIN (Series 5) A wide distribution is advisable and it seems desirable to issue it here also Ohio teachers, pupils and amateurs will, it is hoped, become more interested in our bryological flora]

The samples on the accompanying attached sheet are intended to illustrate the kind of material to be collected, and the method of labelling and mounting the specimens, for the Herbarium It will be noticed that most of the specimens are in "fruit," which is the popular name for the "capsule" that terminates the "se-ta " or slender stem A delicate cap called the "ca-lyp-tra, ' may usually be seen, completely or partially covering the capsule before it is fully mature The terminal portion of the capsule, called lid or ' o-per-cu-lum, ' often drops off when maturity is reached, in this manner the ' spores " or microscopical non-sexual reproductive bodies produced within, are allowed to escape The mouth or opening of the spore case (capsule) is surrounded by a row of slender teeth, called collectively the "per-i-stome," this may be clearly seen with the aid of a lens after the ripe operculum is removed The accompanying diagrammatic figures illustrate the parts just mentioned

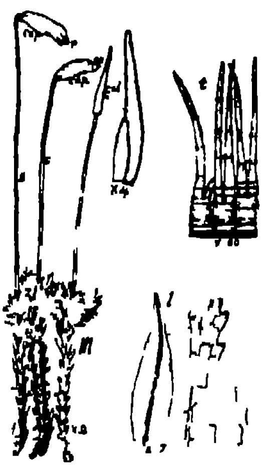

Fig 1

The life history, or cycle of development, of our common Mosses may be briefly sketched as follows When the spores germinate a slender branching tube, or alga-like filament, appears which has been designated the 'pro-to-ne-ma " This contains chlorophyll, it grows in moist protected places and here and there develops root like threads, called "rhi-zoids," which anchor it to the soil "Gem-mae ' or buds also appear on the protonema and these develop into the upright clustered stems that bear the leaf-like structures At the apex of the "ac-ro-car-pous" mosses, and from the sides in 'pleu-ro-car-pous" species, there are formed the organs for sexual reproduction, namely, "an-ther-id-i-a" and "arch-e-go-ni-a,' these are surrounded by a cluster of leaf-like bracts, called

FIG 1 —A common Moss (M) bearing fruit (*s* and *cap*) one capsule is old one fresh, one immature and covered by the calyptra (*cal*) the teeth (*t*) of the peristome (*p*) and a leaf (*l*) magnified are also shown

the "per-i-che-ti-um" or perichetial scales. This structure, consisting of the delicate reproductive bodies and their conspicuous and surrounding protecting organs, has been called the "flower" of the mosses.

The microscopic bodies produced in the antheridia (and called "sper-mat-o-zoids"), and that produced in the archegonia (and called the "o-o-sphere"), are designated by the term "gam-etes;" it is their union that constitutes "fertilization." It can now be understood why this stage of the development of the moss plant, as outlined in the preceding paragraph, is designated by the term "gam-e-to-phyte;" it is the plant (or generation) that produces the gametes. It is in popular language the "moss" plant.

The fusion of the two gametes results in the production of the sexual spore, called the "o-o-spore;" it develops at once into the second generation, or second stage in the life-cycle of the moss plant, which is called the "spo-ro-phyte." It consists of the seta and capsule; the lower end ("foot") of the seta becomes early embedded and fixed in the tissue of the gametophyte, and from it is derived the nourishment necessary to complete the development of the sporophyte, or the plant that produces the numerous non-sexual spores. This "alternation of generations,"—that is, the alternation of gametophyte and sporophyte, —is not peculiar to Mosses, but occurs also in the Pter-id-o-phytes and Sper-mat-o-phytes.

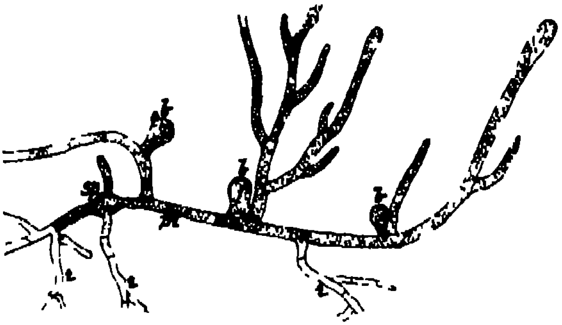

Fig 2

CLASSIFICATION OF THE VEGETABLE KINGDOM.

I. Thal-lo-phytes, as the Slime-moulds, Bacteria, Common Algae (green Pond-scum, etc.), Marine Algae ("Sea-moss"), Moulds, Mildews, Smuts, Rusts, Mushrooms, Toadstools, Puffballs, etc.

II. Bry-o-phytes; The Mosses and Liverworts.

III. Pter-id-o-phytes; The Ferns, Club-mosses and Horsetails.

IV. Sper-mat-o-phytes; The Gymnosperms (Pines, etc.) and Angiosperms (Monocotyls and Dicotyls).

Fig 2.—The growth or protonema (*pr*,) from the spore (*Sp*), having rhizoids (*r*), and buds (*b*), from which stems develop

ORDERS OF MOSSES.

1. Sphag-na-les; the Bog-mosses or Sphagnum.
2. An-dre-æ-a-les; one genus of small Mosses in mountain regions.
3. Ar-chid-i-a-les; only one very short-stemmed species.
4. Bry-a-les; the common Mosses occurring in Ohio.

The only book that could be used by beginners in identifying Mosses, is Grout's "Mosses with a Hand-lens," price $1.10; procure if wanted from the author, or if placed in our hands the order will be attended to. The Manual by Lesquereux and James could be used by advanced students.

It is earnestly requested that contributions of Mosses for the STATE HERBARIUM from every County in Ohio be made. Please send an ample amount of each kind, enclosed in a temporary paper pocket or envelope; with each specimen lay a slip of paper or temporary label, giving *locality, date and collector's name*, also any notes that are made with reference to habitat or habit of the plants. The donor's name and other data will be placed on the permanent label accompanying the herbarium specimens.

ADDITIONAL NOTE ON THE SYNDESMON INVOLUCRE.

A. WETZSTEIN

In addition to the observations made by Mr. F. H Burglehaus, Toledo, Ohio, concerning the involucral leaves of Syndesmon thalictroides Hoffmg, as stated in No 5 of the OHIO NATURALIST, I also confirm the contradiction in the habitus of plants growing in Auglaize County with the description in Britton & Brown's Flora. All specimens I found here have no sessile involucral leaves, but petioles mostly about one-fourth of an inch in length. Especially the later flowering plants, that often grow over one foot high, show petioles of more than one-half inch in length, while even the earliest—collected about the middle of April, and no more than three inches high—exhibit distinctly petioled involucral leaves.

It might be very interesting to find out the range of plants with sessile involucres—for I do not at all think this description of Syndesmon to be an error in so carefully prepared a Flora as Britton & Brown's is, the more as the given figure shows strictly sessile involucres too.

St. Marys, Ohio

MEETINGS OF THE BIOLOGICAL CLUB.

FEBRUARY MEETING

The meeting of the Biological Club, held in the Zoological lecture room on the evening of February 4th, 1901, was presided over by the president, Prof. Osborn, about thirty being present.

Prof. Lazenby presented "Remarks on Poisonous Plants" He mentioned many of the poisons to which the poisonous properties of various plants are due. Many cases of poisoning are caused by poisonous fungi gathered with edible mushrooms, and greens gathered by persons unacquainted with poisonous herbs Stramonium has been known to cause cases of poisoning by being gathered in greens. The distribution of poisonous plants through the various botanical orders was discussed, and the fact was revealed that a large percentage of the orders contain such species.

Prof. Ball spoke on "Collecting in Colorado." His remarks on both faunal and floral conditions are valuable to all, and especially to those who collect in that western state. He emphasized the fact that in collecting Hemiptera, general sweeping is not productive of the best results. Many of the grasses which grow in that country are at least partially recumbent, and for that reason the sweeping net misses most of the desirable species. The species of insects which feed on these grasses are best taken by searching about the roots, or by lifting up the stems and scrutinizing them closely. Many new or rare species of Hemiptera have been procured in numbers in this way.

He exhibited many photographs and drawings which revealed the picturesqueness of the country, something of the flora, and the difficulties railroad companies experience in getting a track across the mountains, and left with many present a desire to see the remarkable scenery for themselves,

MARCH MEETING.

The Biological Club met in Townshend Hall on the evening of March 4, 1901, the lantern being kindly furnished and operated by Professor Hunt.

The board of editors through its secretary, Mr. Griggs, recommended that the offer of Professor Kellerman to take one-half the numbers of the first volume of the OHIO NATURALIST for $125.00 be accepted; and that Professors Schaffner, Osborn and Kellerman be appointed a committee to consider the disposition of exchanges.

The report was unanimously accepted by the club.

Mr. Griggs reported that he and Mr. Tyler had procured a set of two great horned owl's eggs from an old hawk's nest in a beech tree north of the city, on March 4th.

The paper of the evening was given by Professor Osborn on "The Naples Zoölogical Station" The paper was illustrated by lantern and many views of historic places in Europe were given. Naples and the surrounding country with Vesuvius, Pompeii and other points of natural or historic interest were shown in a series of fine views from photographs. The station building with the beautiful grounds surrounding it appeared in several of the views. The speaker dwelt at some length on the opportunities given investigators, the methods of work, equipment in laboratories and library, and the cordiality of the staff in charge, and expressed the hope that many of the students in his hearing might at some future time enjoy the privileges of a sojourn at the station.

Mr. Modesta Quiroga was elected to membership.

JAS. S. HINE, Secretary.

NEWS AND NOTES.

In the present number of the NATURALIST is published some of the work done last summer at the Lake Laboratory, located at Sandusky, O For the announcement for the summer of 1901, or any other information, address Herbert Osborn, Director, Ohio State University, Columbus, O.

Special Papers No. 3, Ohio State Academy of Science, has been distributed. This paper deals with "The Preglacial Drainage of Ohio," and the authors are W. G. Tight, Granville, J. A. Bownocker, Columbus, J. H. Todd, Wooster, and Gerard Fowke, Chillicothe. The paper is a neat pamphlet of seventy-five pages, with a number of maps and half-tones.

Referring to Burglehaus' note on Syndesmon (OHIO NATURALIST, 1:72), I may say that I have a number of specimens from Eastern Kansas, all of which have sessile involucral leaves. Some of the specimens in the Ohio State Herbarium have sessile leaves, while others have involucral leaves with petioles one inch or less in length. That there can be no mistake in the interpretation of what is supposed to constitute an involucral leaf is shown from the following statement in Britton and Brown's Flora, 2:60:—" Involucre of three compound sessile leaves, leaflets stalked." Mr. S. E. Horlacher, of Dayton, Ohio, writes that all the specimens in his herbarium agree with the Flora in having sessile involucral leaves. There may be several forms of Syndesmon distinct enough to designate as varieties; there is at least a large amount of variation.

J. H. SCHAFFNER.

The Ohio Naturalist

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Vol. 1. MAY, 1901 No. 7

VARIATION IN SYNDESMON THALICTROIDES.

W. A. Kellerman.

This charming spring flower called in popular language Rue-Anemone, indigenous to eastern North America, has been known from early times, and as in many other equally unfortunate cases has had imposed upon it by botanists a superfluity of scientific names. Linnaeus in his Species Plantarum, 1753, listed it as Anemone thalictroides; in 1803 Michaux called it Thalictrum anemonoides; it was rechristened as Syndesmon thalictroides in 1832 by Hoffmansegg; finally Spach in 1839 proposed the name Anemonella thalictroides. Botanists to-day consider our plant as more properly placed in Hoffmansegg's genus Syndesmon, and for it the earliest specific name, applied by Linnaeus, is very properly retained, hence the correct designation in botanical language is Syndesmon thalictroides (L.) Hoffmg.

The extent of variation in this plant has been but partially noted heretofore. The tabulation given below indicates the results of observations made the latter part of April and the first of May this year in regard to the number of flowers and the variation in the involucral leaves. As to whether these are sessile as given in our Manuals, notes have appeared on previous pages of this Journal by Messrs. Burglehaus, Wetzstein and Schaffner, cf. pp. 72, 104 and 106.

The number of flowers is normally three and the involucral leaves two. A diagram showing their arrangement is given at A, Fig. 1. The two leaves are not always ternate; they may both be simple, diagrammatically shown at B. A further variation, shown

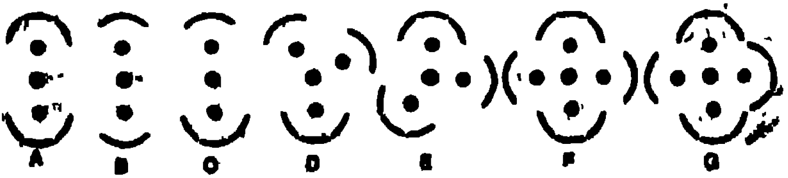


Fig. 1. Diagrams showing arrangement of leaves and flowers

in Fig. 1 C presents one simple and one compound leaf. At D greater complexity is indicated, there being in many plants besides the central flower three instead of only two axillary ones, and only one of the subtending leaves is compound. In the case shown at E two of the three involucral leaves are compound. As shown in F and G four leaves may contribute to form the involucre and each one subtend a flower; in some cases two of the leaves are compound, in others three or even all may be compound. Still other variations along this line occur, but space forbids a fuller enumeration.

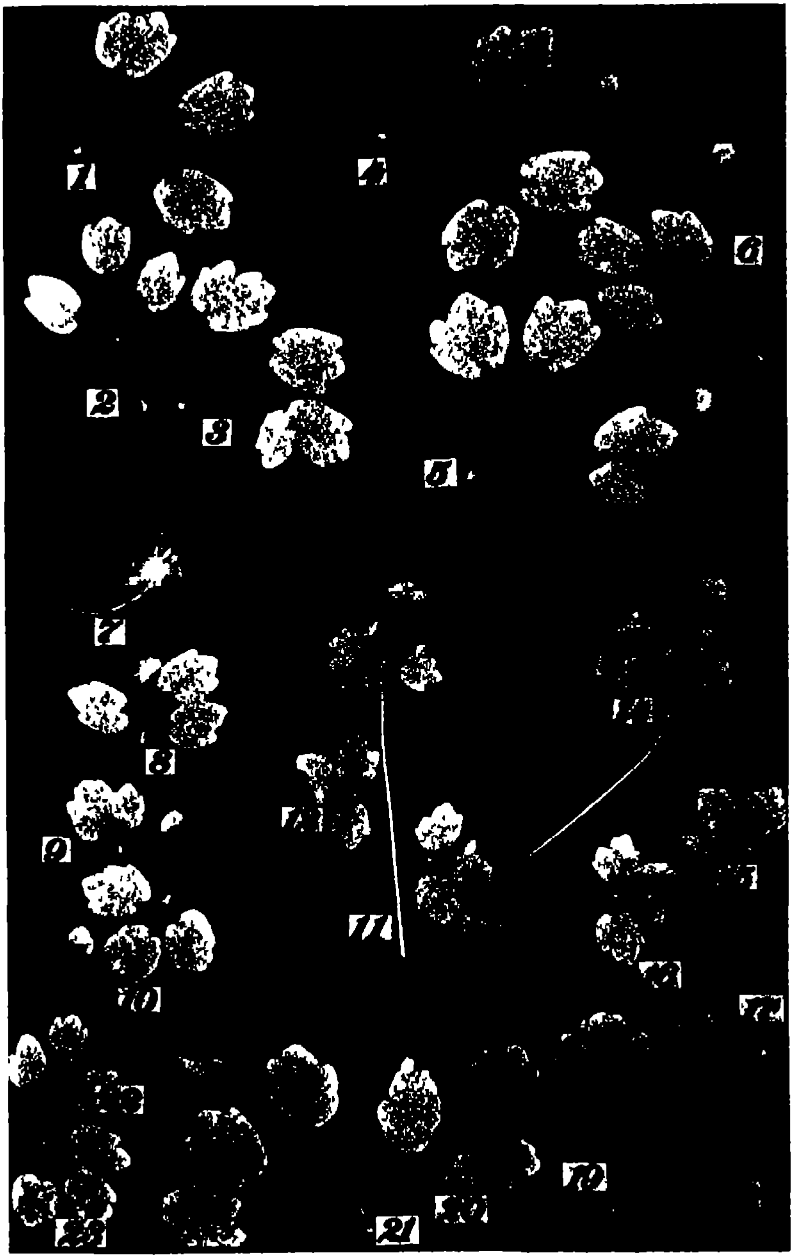
It should be stated that although the pedicels and leaves as shown in the diagrams (Fig. 1) occupy but a small portion of the circle, as a matter of fact the leaflets are spread and so disposed as to occupy the entire area when viewed from above the plant, the leaflets being equidistant from each other, or contiguous but not overlapping, and therefore taking the most advantageous position so far as sunlight is concerned.

The very striking variation in regard to presence or absence of the petiole to the involucral leaves has been previously noted. An inspection of a very large number of specimens collected in the vicinity of Columbus and in Perry and Logan counties, as well as of specimens kindly sent for the purpose by Mr. F. H. Burglehaus, Prof. A. Wetzstein, and Supt. H. N. Mertz, shows that petiolate forms occur exclusively in some localities (Northwestern Ohio); in other places the sessile form only obtains (Eastern Ohio); and yet elsewhere both forms are about equally represented (Central Ohio). We can not regard the petiolate forms as in any real sense a variety (much less a distinct species)—since both sessile and petiolate leaves occur in countless cases on the same plant. But where the petiolate form occurs prevailingly or may be exclusively, it would be advantageous to designate the same; therefore I propose as follows:

Syndesmon thalictroides f. PETIOLATA nova forma. Involucral leaves prevailingly or exclusively with petioles 2-10 or even 25 or more millimeters in length; otherwise like the typical species. Toledo (F. H. Burglehaus), St. Marys (A. Wetzstein) and West Mansfield, occasionally at Columbus and Rendville.

Comparatively few monstrosities were observed. In one case only did merely one leaf and two flowers occur; often but one flower develops though two leaves occur as usual; in a few cases a single small leaf was seen on a pedicel. A more common teratological variation was the elongation of the axis at the usual point of insertion of the flowers and involucral leaves, often distantly separating the leaves with their axillary flowers; in one case the distance between the points of insertion of the leaves was nearly two inches. The sepals are occasionally excessively numerous.

A characteristic very prominent is the similarity of the several stems that come from the same root. If one presents the typical



KELLERMAN ON SYNDESMON.

form of flowers and leaves almost without exception, the second (and third when present) do the same; if one varies in any respect rarely does the remainder fail to follow suit. This can be seen in the tabulation where two or more stems are indicated—both or all are given (except in Nos. 29, 30 and 49) as observed, in the successive serial numbers. Another instance of the persistency of an idiosyncracy, as we may call it, was observed in some Syndesmons taken from the woods by a gardener at Springfield, Ohio, over forty years ago. The flowers were bountifully double, and the plants have each year since faithfully presented the same striking peculiarity.

The tabulation that follows is based on specimens from Toledo (Lucas Co.), Nos. 1-30; from St. Marys (Auglaize Co.), Nos. 31-48; from Steubenville (Jefferson Co.), Nos. 49-65; from West Mansfield (Logan Co.), Nos. 66-76; from Rendville (Perry Co.), Nos. 77-88; and from Columbus, Nos. 89-100. The number of stems to each plant is given in the second column; then follow in order the number of flowers to each stem, the number of simple leaves with length of their petioles in *millimeters*, the number of compound leaves with length (also in *millimeters*) of their petioles and finally of their petiolules.

TABULATION.

No.	Stems	Fls.	Simp. lvs.	Pet.	Comp. lvs.	Pet.	Petl.
1	2	4	1	3	2	14	3-3
2	2	3	1	4	1	4	2-3
3	1	3	1	4	1	4	2-3
4	2	4	1	10	2	9	3-7
5	2	3	0	—	2	3	0-2
6	1	3	0	—	2	6	3-6
7	1	3	1	13	1	15	6-6
8	2	4	1	12	2	12	3-7
9	2	4	1	3	2	3	2-3
10	3	4	1	11	2	12	2-4
11	3	4	0	—	3	6-7	2-4
12	3	4	0	—	3	2-3	1-2
13	2	4	3	6	0	—	—
14	2	3	2	6	0	—	—
15	3	4	1	9	2	9	2-5
16	3	4	1	3	2	7	2-4
17	3	4	0	—	3	3	1-2
18	2	5	1	6	3	3	2-5
19	2	3	2	3	0	—	—
20	1	3	0	—	2	7	2-4
21	1	4	2	4-5	1	5	2-2
22	3	3	0	—	2	9	3-7
23	3	3	0	—	2	6	2-3
24	3	3	0	—	2	3	0-2

No. 25	Stems 1	Fls. 1	Simp. lvs. 1	Pet. 4	Comp. lvs. 1	Pet. 5	Petl. 3-3
“ 26	“ 1	“ 4	“ 1	“ 5	“ 2	“ 7	“ 2-4
“ 27	“ 2	“ 4	“ 1	“ 12	“ 2	“ 16	“ 3-3
“ 28	“ 2	“ 3	“ 0	“ —	“ 2	“ 7	“ 2-3
“ 29	“ 7	“ 4	“ 1	“ 3	“ 2	“ 10	“ 3-6
“ 30	“ 7	“ 3	“ 0	“ —	“ 2	“ 3	“ 3-6
“ 31	“ 2	“ 4	“ 0	“ —	“ 3	“ 3-4	“ 1-2
“ 32	“ 2	“ 3	“ 0	“ —	“ 2	“ 2-3	“ 1-2
“ 33	“ 1	“ 4	“ 1	“ 2	“ 2	“ 3	“ ½-2
“ 34	“ 1	“ 3	“ 0	“ —	“ 2	“ 4-5	“ 1-2
“ 35	“ 1	“ 3	“ 1	“ 4	“ 1	“ 5	“ 1-2
“ 36	“ 1	“ 3	“ 1	“ 3	“ 1	“ 4	“ ½-2
“ 37	“ 1	“ 3	“ 0	“ —	“ 2	“ 4	“ 1-2
“ 38	“ 2	“ 3	“ 0	“ —	“ 2	“ 4	“ 1-2
“ 39	“ 2	“ 3	“ 0	“ —	“ 2	“ 6	“ 2-3
“ 40	“ 1	“ 3	“ 0	“ —	“ 2	“ 2-3	“ 1-2
“ 41	“ 2	“ 3	“ 1	“ 3	“ 1	“ 3	“ 1
“ 42	“ 2	“ 3	“ 1	“ 2	“ 1	“ 2	“ 1-1½
“ 43	“ 1	“ 3	“ 0	“ —	“ 2	“ 5	“ 1-2
“ 44	“ 3	“ 3	“ 2	“ 5	“ 0	“ —	“ —
“ 45	“ 3	“ 3	“ 2	“ 6	“ 0	“ —	“ —
“ 46	“ 3	“ 3	“ 2	“ 3	“ 0	“ —	“ —
“ 47	“ 2	“ 3	“ 1	“ 4	“ 1	“ 4	“ 0
“ 48	“ 2	“ 3	“ 2	“ 1	“ 0	“ —	“ —
“ 49	“ 1	“ 3	“ 0	“ —	“ 2	“ 0	“ 12-15
“ 50	“ 5	“ 3	“ 0	“ —	“ 2	“ 0	“ 22-23
“ 51	“ 5	“ 3	“ 0	“ —	“ 2	“ 0	“ 6-10
“ 52	“ 5	“ 3	“ 0	“ —	“ 2	“ 0	“ 3-6
“ 53	“ 5	“ 5	“ 2	“ 1	“ 2	“ 0	“ 1-1½
“ 54	“ 5	“ 3	“ 0	“ —	“ 2	“ 0	“ 1
“ 55	“ 1	“ 3	“ 0	“ —	“ 2	“ 0	“ 6-6
“ 56	“ 6	“ 4	“ 1	“ 15	“ 2	“ 0	“ 15-25
“ 57	“ 3	“ 4	“ 1	“ 2	“ 2	“ 0	“ 6-26
“ 58	“ 3	“ 4	“ 1	“ 2	“ 2	“ 0	“ 20-25
“ 59	“ 3	“ 4	“ 1	“ 1	“ 2	“ 0	“ 3-6
“ 60	“ 3	“ 4	“ 1	“ 1	“ 2	“ 0	“ 15-20
“ 61	“ 3	“ 4	“ 2	“ 0	“ 2	“ 0	“ 3-6
“ 62	“ 3	“ 3	“ 0	“ —	“ 2	“ 0	“ 4-6
“ 63	“ 3	“ 4	“ 1	“ 1	“ 2	“ 0	“ 15-23
“ 64	“ 3	“ 4	“ 0	“ —	“ 3	“ 0	“ 5-13
“ 65	“ 3	“ 5	“ 1	“ 0	“ 3	“ 0	“ 2-10
“ 66	“ 2	“ 2	“ 1	“ 2	“ 1	“ 2½	“ 1½-2
“ 67	“ 2	“ 3	“ 2	“ 2	“ 0	“ —	“ —
“ 68	“ 2	“ 4	“ 1	“ 1½	“ 2	“ 2	“ 2-3
“ 69	“ 2	“ 4	“ 0	“ —	“ 3	“ 3-5	“ 1-3
“ 70	“ 2	“ 4	“ 1	“ 1	“ 2	“ 1½-2	“ 2

No.	71	Stems	2	Fls.	4	Simp. lvs.	1	Pet.	2	Comp. lvs.	2	Pet.	3-4	Petl.	2
"	72	"	2	"	4	"	1	"	2	"	2	"	2	"	1-2
"	73	"	2	"	3	"	0	"	2	"	2	"	4-5	"	2-3
"	74	"	2	"	4	"	1	"	2	"	2	"	2	"	1-2
"	75	"	2	"	3	"	0	"	—	"	2	"	4	"	2-3
"	76	"	1	"	1	"	2	"	1	"	0	"	—	"	—
"	77	"	1	"	3	"	0	"	—	"	2	"	0	"	5-12
"	78	"	1	"	3	"	0	"	—	"	2	"	0-2	"	3-7
"	79	"	1	"	3	"	0	"	—	"	2	"	2-3	"	1-4
"	80	"	1	"	3	"	0	"	—	"	2	"	1-3	"	2-5
"	81	"	2	"	3	"	0	"	—	"	2	"	5-6	"	5-9
"	82	"	2	"	3	"	0	"	—	"	2	"	1	"	2
"	83	"	1	"	4	"	0	"	—	"	3	"	0-6	"	2-3
"	84	"	2	"	3	"	0	"	—	"	2	"	2-3	"	1-2
"	85	"	2	"	3	"	0	"	—	"	2	"	0	"	15-18
"	86	"	2	"	3	"	0	"	—	"	2	"	0	"	2-5
"	87	"	2	"	4	"	0	"	—	"	3	"	0-7	"	0-6
"	88	"	2	"	5	"	0	"	—	"	4	"	0	"	2-4
"	89	"	2	"	4	"	1	"	4	"	2	"	0	"	4-6
"	90	"	2	"	4	"	1	"	5	"	2	"	0	"	5-8
"	91	"	2	"	4	"	1	"	1	"	2	"	0	"	3-5
"	92	"	2	"	4	"	1	"	2	"	2	"	0	"	5-8
"	93	"	1	"	4	"	0	"	—	"	3	"	0-10	"	3-23
"	94	"	1	"	5	"	1	"	22	"	3	"	0-25	"	4-23
"	95	"	1	"	4	"	0	"	—	"	3	"	0-15	"	9-33
"	96	"	1	"	4	"	0	"	—	"	3	"	0-3	"	6-25
"	97	"	1	"	3	"	0	"	—	"	2	"	6-7	"	2-4
"	98	"	1	"	1	"	2	"	4	"	0	"	—	"	—
"	99	"	2	"	4	"	1	"	4	"	2	"	5	"	2-3
"	100	"	1	"	3	"	1	"	3	"	1	"	4	"	1-2

From the above tabulation it may be seen that of the plants selected at random for examination 51 per cent. of the stems have three flowers and 49 per cent. have four or more; 10 per cent. have simple involucral leaves only, 44 per cent. have both simple and compound, and 46 per cent. have only compound involucrate leaves. Of the total number, 88 per cent. have one or all of the involucrate leaves petiolate, and 12 per cent. have only sessile ones. Observations of others on this interesting little plant are solicited—especially should the Ohio botanists, amateurs and pupils furnish such notes for publication in the OHIO NATURALIST.

EXPLANATION OF PLATE 9.—Syndesmon thalictroides, the leaves, etc., were used as negatives and the photographs were reduced by the engraver to less than one-half the natural size Figs 1, 2 and 3 show leaves from the same plant, figs. 4, 5 and 6 are from one and the same plant, figs 7, 8, 9 and 10 are parts of the same plant, figs 11, 12 and 13, also 14, 15 and 16 are each of one plant respectively, figs. 17 to 23 inclusive illustrate leaf variation, specimens taken from different plants, except figs 22 and 23 which are from one and the same plant

DESCRIPTION OF NEW SPECIES OF STRATIOMYIDÆ WITH NOTES ON OTHERS.

JAS. S. HINE.

In a collection of several species of Stratiomyidae from Ohio, and a number of western species, I find something which may be of interest to students of the family.

Specimens of *Allognosta fuscitarsis*, Say, show some degree of variation in the extent of the pale color on the disc of the abdomen. Some of the females have the abdomen nearly or wholly black. Specimens of *A. obscuriventris*, Loew, have the body entirely black; the legs are darker and the form is considerably smaller than *fuscitarsis*. Both species are common at Columbus during May.

PTECTICUS (SARGUS) TRIVITTATUS, Say.

A species of *Ptecticus* taken abundantly at Cincinnati by Chas. Dury agrees so well with Say's *Sargus trivittatus* that I cannot convince myself that it is anything else. Specimens when first taken agree more closely with Say's description than the same specimens do after they have been in the cabinet awhile and have become dry. The green color that Say mentions is present in some while others are yellowish or brownish. The broad, dusky band that Say described as appearing on the basal part of each abdominal segment beyond the second is conspicuous, being of greatest extent on the fifth and sixth.

EUPARYPHUS MAJOR n sp.

Female, length 9mm. Head yellow; vertex, a wide stripe from vertex to mouth, widened at antennae and spreading out on the cheeks in the region of the mouth, antennae and occiput, black; eyes hairy. Thorax shining; apical two-thirds of scutellum including the spines, an irregular spot each side between the scutellum and base of the wing, four longitudinal lines abbreviated behind, a triangular spot before the base of the wing, and two spots beneath it, bright yellow. There is also a minute yellow spot on each side of the thorax posterior to the lower corner of the eye, the yellow markings on the disc of the thorax extend for one-fifth of their length behind the transverse suture, while those on the sides extend from the humerus to the transverse suture. The femora except at base and apex are black, and the last three tarsal joints are brown, remaining parts of the legs are yellow; wings hyaline, veins dull yellow, halteres bright yellow. Abdomen black; a spot under the scutellum, a spot each side on the lateral part of the second segment, an elongate oblique band nearly meeting its fellow of the opposite side of each of the third and fourth segments, and apex, yellow. On the venter the hind margins of the third and fourth segments are yellow for their entire width, nearly the whole of the middle part of the second segment and a narrow band on the posterior margin of the first segment are also yellow. The lateral margins of the segments of the abdomen are black between the yellow markings, and there is no connection between the yellow markings on the abdomen.

A female specimen taken by E. J. Oslar at Boulder, Colorado, August 19, 1899.

In many respects this species agrees with Osten Sacken's *decem-maculatus*, but it cannot be that species as the markings are very different. Aside from the hairy eyes it appears to belong to *Euparyphus*. The third joint of the antennae is composed of six rings with the last ring the longest. The fifth posterior cell meets the discal and its general form agrees very closely with *bellus* and *tetraspilus*

AKRONIA n. gen. (Fig. 1.)

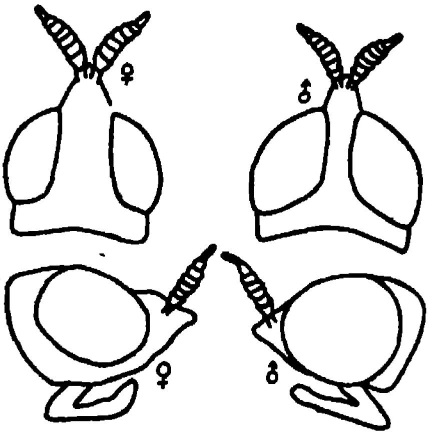


Fig 1

Head conically produced. Front in the female noticeably wider than the eye, in the male about half as wide as in the female. Antennae three-jointed, first and second joints about equal in length, third much longer than the other two together and composed of six rings. Posterior orbits wide in both sexes, but widest in the female, scutellum without spines, four posterior veins arising from the discal cell, abdomen short and broad, nearly circular in outline.

Named for Akron, Ohio, in which vicinity I have procured many rare species.

AKRONIA FRONTOSA n. sp.

Length 4-4½mm. Dull black, sparsely clothed with very short, light-colored hair; eyes widely separated in both sexes, naked; antennae entirely in front of the eyes; front produced more in the female than in the male, posterior orbits present in both sexes, widest in the female; thorax nearly equally four-sided, scutellum without spines, wings hyaline, veins bounding costal, basal, marginal, and first and second sub-marginal cells heavy and dark colored; discal cell rather small emitting four posterior veins; legs black, knees and tarsi lighter colored than the other parts; abdomen short and wide. Five males and four females taken at Hawkins, near Akron, Ohio, May 21, 1899.

This is so distinct from species of *Nemotelus* in general appearance, and structure of the head, especially in the male, that it seems best to make it the type of a new genus.

CHRYSOCHROMA NIGRICORNIS Loew.

This is a common species in southern Ohio. Specimens may be found resting on the upper side of leaves and are easily approached. In the female the white fronted line which Loew mentions is very conspicuous and extends from one eye to the other above the antennae. In some specimens the white lateral, thoracic lines are very easily seen, but in others these lines are brownish. The male has much the appearance of the female, the eyes are broadly contiguous, leaving a small vertical triangle which is largely occupied by the ocelli; the lateral thoracic lines in this sex are dark brown and therefore are not such a contrast to the bright green thorax as in the female.

I had some trouble in locating the genus of this species by Dr. Williston's key. The species is not elongate, but of much the same form as *Microcrysa polita*. A comparison was made with the type.

OHIO BATRACHIA IN THE ZOOLOGICAL MUSEUM OF THE O. S. U.

MAX MORSE.

Fam. PROTEIDÆ.

Necturus maculatus Rafin. University Lake, Olentangy River, and Lake Erie. Near Sandusky, on both the Lake and Bay shore, decaying specimens of the mud-puppy, mostly young, were found in numbers in 1900. Almost all were covered with a fungus—probably *Saprolegnia.*

Fam CRYPTOBRANCHIDÆ.

Cryptobranchus alleganiensis (Daudin.) Columbus

Fam. AMBLYSTOMATIDÆ.

Amblystoma opacum (Graveah). Portsmouth and Sugar Grove.

Amblystoma tigrinum (Green). Columbus This salamander appears early in the Spring and is often found in small pools. Individuals are taken nearly every Autumn in the basement of the Biological Hall while they are seeking shelter. A specimen taken thus had many characteristics in common with *xiphias* Cope and it is doubtful how valid *xiphias* is, as a species.

Amblystoma microstomum (Cope). Columbus and New London.

Fam. Plethodontidæ.

Plethodon cinereus cinereus (Green). Sugar Grove.

Plethodon cinereus erythronotus (Green). Sugar Grove, Columbus, and Worthington. In the early part of the year this is the commonest salamander in the ravines in Franklin County. It is found generally away from water, under loose debris two or more rods from the stream.

Plethodon glutinosus (Green). Sugar Grove. This salamander is found in such localities as were mentioned for *P. c. erythronotus.*

Gyrinophilus porphyriticus (Green). Sugar Grove.

Spelerpes bilineatus (Green). Sugar Grove. Habits apparently aquatic.

Spelerpes longicauda (Green). Sugar Grove. This salamander is abundant in this region where it may be found in May under stones at the edge of the water together with its eggs; the eggs are attached to the under side of a hollow stone. Some individuals were found in May, 1900, away from water.

Spelerpes ruber (Daudin). Fairfield County.

Desmognathus fusca (Rafin). Sugar Grove and Perry Co. Aquatic in habits.

Fam. Pleurodelidæ.

Diemictylus viridescens miniatus Rafin. Sugar Grove.

Fam. Bufonidae.

Bufo lentiginosus Shaw. Columbus and Knox County. This is the common toad of Central Ohio.

Bufo lentiginosus americanus LeConte. A specimen from the sand dunes of Cedar Point, Sandusky, Ohio

Fam. Hylidæ.

Acris gryllus crepitans Baird. Knox County, Central College and Columbus. The common cricket-frog of Central Ohio is this subspecies. The young resemble the species *gryllus* LeConte in having the under surface of the thigh reticulated and blotched.

Chorophilus triseriatus (Wied.). Sugar Grove.

Hyla versicolor LeConte. Knox County and Columbus.

Hyla pickeringii Storer. Sugar Grove.

Fam. Ranidæ.

Rana virescens Kalm. Sugar Grove and Columbus.

Rana palustris LeConte. Sugar Grove.

Rana sylvatica LeConte. Knox County and Sugar Grove.

Rana clamata Daudin. Columbus.

Rana catesbiana Shaw. Columbus.

Summary for Batrachia.—Families 8, Genera 12, Species 25.

THE PROMETHEA MOTH, CALLOSAMIA PROMETHEA.

HERBERT OSBORN.

This beautiful moth is one of the rather common species belonging to the group of silkmaking Lepidoptera. The moths appear in May or June. The female is light rusty brown and drab with a darker area across the middle of the wings, while the males are much darker, nearly black, and differ further from the females in the shape of the wings and markings as shown in the figures.

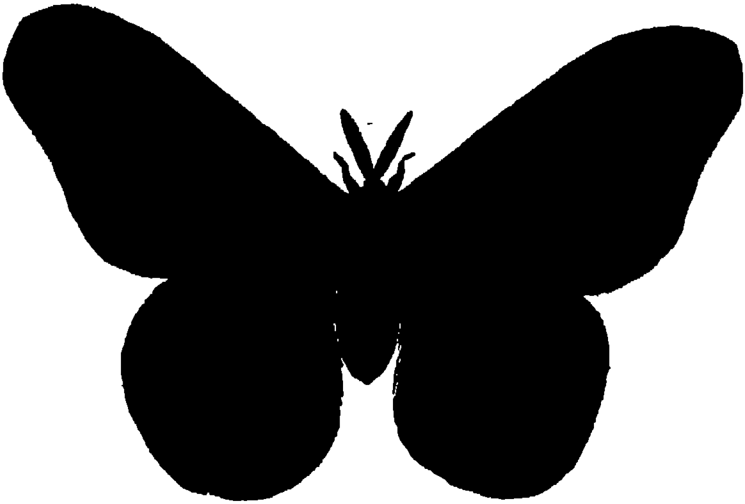


Fig 1 *Callosamia promethea*, female (H O ad. nat 1899)

The eggs are laid in early summer almost immediately after pairing, and hatch in course of a few days, the larvae growing through the summer. The cocoons are hung to twigs of trees by a silken cord, and quite often a leaf is utilized as the outer covering within which the elongate oval cocoon is built. In any case the cocoon bears resemblance to a withered curled leaf hanging by its petiole. In this manner cocoons hang upon the trees through the winter.

They are found most commonly on wild cherry, this being apparently the favorite food plant of the larva. They feed however on a large number of common trees and shrubs.

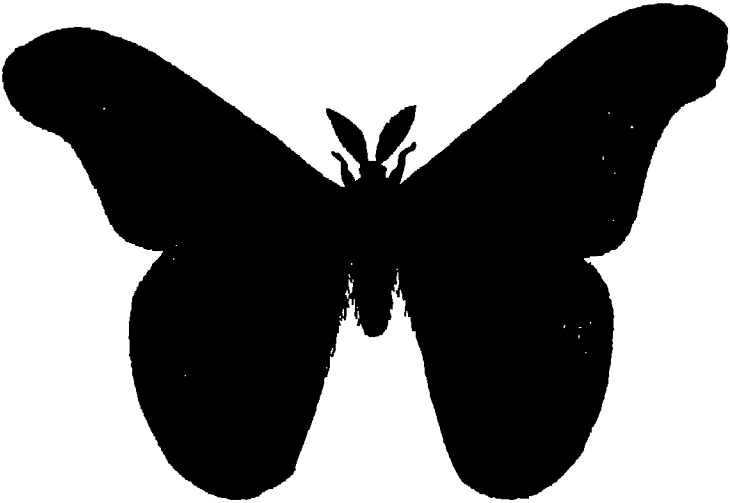


FIG 2. *Callosamia promethea*, male (H O. ad nat 1880)

The figures of the moth, male and female, were drawn twenty-one years ago, and having now come of age they may perhaps be trusted to make their first public appearance.

MEETING OF THE BIOLOGICAL CLUB.

The Biological Club met in Zoological lecture room on the evening of April 1, 1901. Professor Osborn presided.

Professor Schaffner reviewed a paper entitled *Zur Kenntniss der Zelltheilung bei Myriopoden*, published in *Archiv fur Mikroskopische Anatomie*

Dr. Morrey spoke on the subject, "Two years in Europe as a Student." Most of the time was spent at the University of Vienna, although the University at Zurich and the Pasteur Institute at Paris were each attended for a short term.

The University of Vienna ranks among the first in the advantages offered to medical students. The hospitals of the city are noteworthy on account of the large number of cases and the great variety of diseases treated. The numerous holidays observed in Vienna seriously interrupt college work. Hardly a week passes in which there is not one or more holidays on which work is wholly suspended.

The speaker placed on the exhibition table a fine series of photographs procured during his stay abroad. These furnished a treat for those present after the regular program was completed.

JAS. S. HINE, Secretary.

NEWS AND NOTES.

The Summer Field Meeting of the Ohio State Academy of Science will be held at Wooster, Ohio, on Friday and Saturday, May 31 and June 1, 1901, under the auspices of the University of Wooster, the Ohio Experiment Station and the Wooster Field Naturalist's Club. The plan includes Friday about the small lakes southwest of Wooster, and an evening meeting in Wooster; Saturday morning at the Experiment Station, to be followed by an excursion to North Lawrence with its mines and Fox Lake with its tamarack bog.

Prof. Charles S. Prosser in an article in the Am. Jour. of Sci. 11:191-199, 1901, discusses the names applied to the formations of the Ohio Coal-measures. The following names are proposed.

Present Names	Proposed Names
Upper Barren Coal Measures	Dunkard formation
Upper Productive Coal Measures	Monongahela formation
Lower Barren Coal Measures	Conemaugh formation
Lower Productive Coal Measures	Allegheny formation

The Philadelphia Fleabane (Erigeron philadelphicus L.) is one of our interesting spring plants and will repay careful study. The leaves of the stem in most individuals have a decided polarity and for the most part are twisted so as to stand in a single plane. In this respect the plant is as striking as any of the so-called compass plants, although the plane in which the leaves lie may be in any direction. Another interesting adaptation is the drooping of the top of the young plant. The entire inflorescence nods at first and finally the individual heads, but one by one these assume the upright position as the flowers begin to open.

J. H. S.

WINTER ADAPTATION OF OPUNTIA.—The Ohio species of cactus, Opuntia humifusa Raf., has an interesting habit which seems to be a protective measure against cold. At the approach of Winter the flattened stems lose their upright position and press themselves closely to the surface of the ground.

The stems lose considerable of their moisture at the same time, becoming wrinkled but not at all flaccid. By the end of April they are again upright and distended.

F. J. T.

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A STUDY IN VARIATION ON THE WING OF THE HONEY BEE.

F. L. LANDACRE.

While working on the Honey Bee in the laboratory at the University it was observed that the number of hooks connecting the posterior wing with the anterior was not constant.

The query at once arose as to the amount of variation there might be between different bees in the same hive and also between different hives. Out of this grew a somewhat practical problem as to whether the increase in number of hooks was associated with a decrease in the size of the wing, or whether the increase in number of hooks also implied an increase in size of wing.

The wings of the bee are undoubtedly more efficient for being closely attached to each other. The life of the workers is so short, being only about three weeks, and their activity so great that any increase in efficiency, especially in the organs of flight, must have a very direct influence on the welfare of the whole swarm. So far as the well being of the swarm depends upon nutritive processes the efficiency of the hive is equal to the average efficiency of the workers. Now, if the increase in number of hooks and the consequent, firmer attachment of the wings is compensated for by a smaller wing, there is much less opportunity for the operation of natural selection on the individual bees than if the greater number of hooks is always associated with a broader or longer wing.

This selective process might occur either in the hive or between hives. If it occurs in the hive it would increase the efficiency of the hive somewhat; but if it occurs between hives it finally means the elimination of the weaker hive and the consequent increased efficiency of the species.

In order to find out the real conditions, one of the students, Mr. J. N. Frank, took twenty-five workers from each of four hives and counted the number of hooks on each wing, right and left, and also measured the width of the anterior and posterior wings on each side, The width only was taken on account of the difficulty in finding a good point at the base of the wing from which to measure the length. The results are so uniform that the width probably gives sufficient data from which to draw conclusions.

Of the four hives studied, numbers one and two were very weak. Number three was a strong hive which made forty (40) pounds of extra honey in the summer of 1900. Number four was weaker than number three and made only ten (10) pounds of extra honey.

The complete measurements are too long to give in detail, and the averages only will be offered here.

AVERAGES OF TWENTY-FIVE MEASUREMENTS FOR EACH HIVE TAKEN WITH AN EYE-PIECE MICROMETER, EXPRESSED IN MM.

HIVE NUMBER ONE.

Average Number of Hooks.		Average Width of Wing.			
Right wing.	Left wing.	Right wing.		Left wing.	
		Ant.	Pos.	Ant.	Pos.
21.3	20.9	4.21	3.61	4 23	3.55

HIVE NUMBER TWO.

Average Number of Hooks.		Average Width of Wing.			
Right wing.	Left wing.	Right wing		Left wing.	
		Ant.	Pos.	Ant.	Pos.
19.2	18.8	4.14	3 48	4.16	3.48

HIVE NUMBER THREE.

Average Number of Hooks.		Average Width of Wing.			
Right wing.	Left wing.	Right wing.		Left wing.	
		Ant.	Pos.	Ant.	Pos.
21.0	21.0	4 06	3.48	4.07	3.50

HIVE NUMBER FOUR.

Average Number of Hooks.		Average Width of Wing.			
Right wing.	Left wing.	Right wing.		Left wing.	
		Ant.	Pos.	Ant.	Pos.
19.6	19.6	4.09	3.47	4.06	3.41

As to the first query concerning the individual variations in a single hive the complete table shows that No. 1 varies from 18-21 hooks, No. 2 from 17-21, No. 3 from 18-23 and No. 4 from 17-21. The right wing is taken as the standard, and the most active hive, No. 3. shows the greatest individual variation. One bee in this hive had only sixteen hooks, the remaining three being straight spines, showing how the hooks have been modified from ordinary hairs. This reversion occurred on three separate wings, in No. 2 one hook on each wing being straight.

As to the relation between the number of hooks and the width of the wing the averages are very definite. Taking hives number one and two from the same apiary, it will be seen that the increase in number of hooks goes with the increase in width of wing. The same relation is shown by hives numbers three and four from another apiary in the case of the posterior portion of the right wing and in both anterior and posterior portions of left wing.

The results are not conclusive as to the relative efficiency of different hives because there are so many conditions entering into the production of large quantities of honey. The number of bees, the care during the winter, the age of the queen, the number of swarms produced, and several other factors would have to be taken into consideration.

The differences in the right and left wings in the bees of the same hive is marked. The right wing has the larger number of hooks, but the left wing is the broader. In hive number one the average number of hooks in the right wing is 21.8, left 20.9; but the anterior wing on the right side is 4.21 mm., while the left anterior wing is 4.28; that is, there is a compensation for the reduced number of hooks in the increased width of the wing. This is true of the first three hives. In the fourth hive there is a slight advantage in favor of the right wing.

The following general conclusions may be drawn from these measurements:

(*a*) There is a variation in the number of hooks in a given hive ranging between 17 and 28.

(*b*) The difference in the number of hooks in the right and left wing is compensated for in a given hive by the increased size of the wing. The right and left wings are in physiological equilibrium.

(*c*) In different hives the increase in the number of hooks is accompanied by an increase in width of wing; that is, the variation is emphasized so that selection would work much more effectively; while in the individual, where—if selection operated on account of this variation—it would have to be between different wings of the same bee, the variation is eliminated.

TWELVE PLANTS ADDITIONAL TO THE OHIO LIST.

W. A. KELLERMAN.

The species named below have not heretofore been recorded as a part of the Ohio flora. The first collector and locality are given for each of the listed species. The serial number prefixed to each name indicates where in the Fourth State Catalogue the species should be inserted.

123a Sorghum vulgare Pers. Occasionally escaped.

270b Secale cereale L. Rye. Occasionally escaped.

781b Dianthus barbatus L. Sweet William. Escaped. Painesville. Otto Hacker.

(1042a Crataegus polybracteata Ashe. Reported previously, but without locality. Franklin, Hocking, and Summit Counties; W. A. Kellerman.)

1042b Crataegus pruinosa Wendl. Logan County, W. A. Kellerman.

1042c Crataegus succulenta. Franklin, Fairfield, Knox, Belmont, Summit, Ottawa, Union, Ross, Carroll, Shelby and Lucas Counties; W. A. Kellerman.

1526b Teucrium occidentale Gr. Hairy Germander. "Ohio", Riddell, 1834, (Bull. Torr. Club, 28:170); Reservoir Park, Perry Co., W. A. Kellerman.

1529a Scutellaria serrata Andr. Showy skullcap. Rio Grande. Gallia County; Ruth E. Brockett.

1605a Solanum tuberosum L. Potato. Escaped.

1609c Petunia violacea Lindl. Occasionally escaped.

1709a Viburnum molle Mx. Soft-leaf Arrow-wood. Scioto County; W. A. Kellerman.

1714a Linnaea borealis L. Twin-flower. Canton, Stark County; Mrs. Theano W. Case.

1986a Chrysanthemum indicum Hortorum. Escaped. Adams County; W. A. Kellerman.

THE FOOD HABITS OF SOME APHROPHORA LARVAE.

E. D. BALL.

The larvae of all the American species of the Family Cercopidae as far as known envelope themselves in a frothy mass. Contrary to popular opinion and to most of the published accounts this froth does not issue as bubbles from the body of the insect, but is made by pushing the tip of the abdomen up out of the froth and grasping, with the anal appendages, a bubble of air and bringing it down and releasing it within a liquid film. This liquid film is simply the excretion from the alimentary canal of the sap which is imbibed by these insects in large quantities. This copious liquid excretion is a common occurrence in other families of the Homoptera. In the Plant Lice (Aphidae) it gathers in drops and is called "Honey Dew." The Leaf Hoppers and Tree Hoppers expel a clear liquid with some force. In some species this is in sufficient amount so that when the insects are numerous the foliage may drip, producing the "Weeping trees" of the Southern States.

This process of froth making in the Cercopidae was discovered and first correctly described by Professor E. S. Morse, of Salem, Mass., and published many years ago in his Elementary Zoology. * His observations were probably made on the larvae of *A. spumarius* which belongs to the genus *Philaenus* as now recognized.

In the genus *Aphrophora* as now limited little is known of the food habits of the larvae. One species (*A. 4-notata*) has been found on various plants and shrubs. The remaining three eastern species, which belong to a different group and are of some shade of brownish testaceous, have been given as feeding on pines in the adult state by various authors. Dr. Fitch has described the larvae of one of these (*A. parallela*, Fig. 4, Plate 10) as forming frothy masses on the tips of pine twigs, and in the Nat'l Museum Coll. are some *Aphrophora* larvae labeled "Pa. On Pine, July 7," that undoubtedly belong to this species leaving little room to doubt the correctness of Fitch's determination.

There are two species belonging to the *parallela* group occurring in the Rocky Mountain region both found in the adult stage on pines. Of one of these (*A. permutata*, Fig. 1, 2 and 3, Plate 10) larvae were found in abundance on two different plants *Chrysopsis villosa* and *Lupinus sp.* Both of these plants grow in clumps and it was always down in the bases of these clumps, some of them often down below the surface of the ground among the roots, that the larvae were found. Often ten or fifteen would be found in a single clump their united froth masses, held up by the coarse stems, reaching a diameter of two inches or more.

The larvae were found in these clumps from late in May until the first week in July in the foot hills, and higher up in the mountains they were just beginning to emerge July 20th. When ready to emerge they climb up a stem during the night far enough to free themselves from the froth and as soon as the sun strikes them in the morning they burst their pupal skins and an hour later they are ready to fly up to the pine trees where their color admirably protects them.

Although both these plants grow very commonly over a wide extent of territory the *Aphrophora* larvae have never been found on them except where they were within a short distance of a pine tree. At first sight it would seem probable that the eggs were deposited in the twigs of the pines, and that the young larvae dropped to the ground, and from there sought out a food plant, as is the case in some Cicadas. But as numerous larvae were found in positions practically inaccessible to any such means of distribution—such as on the opposite side of a sharp ledge of rocks, across a bramble thicket, or even on plants growing in the crevices of bare rocks at a considerable distance above any pines—it seemed nearly certain that the adults must fly back to the plants to deposit their eggs.

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* For a detailed account of this process see Prof Morse's article "A Bubble-blowing Insect." Pop Sc Monthly, May, 1900.

It will be interesting to discover whether a similar food habit occurs in any of the Eastern members of the genus or whether this is peculiar to the western species. It seems possible that original pine-inhabiting species finding themselves unable to maintain their froth masses in their exposed positions on pine branches in such a dry atmosphere were compelled to seek moister conditions such as are afforded by the shade and contact with the earth under these bushy plants.

EXPLANATION OF PLATE.—Fig 1 *Aphrophora permutata* Uhl Adult. X About 7 Common from the Rocky Mountains to the Pacific 1a—Side view of head, showing profile of face

Fig. 2 Pupa of above 2a—Side view of head of pupa

Fig 3 Semi-diagramatic cross-section of a clump of *Chrysopsis villosa* to show relative location of larvae with relation to the froth mass and the surface of the earth

Fig 4 *Aphrophora parallela* Say Adult X About 7 Eastern U S to Ohio and Mich 4a—profile of head of same

THE VERNATION OF SALIX.

ROBERT F. GRIGGS.

Most of the manuals are entirely silent regarding the vernation of the Willows. Sargent* describes their leaves as "variously folded in the bud" and under different species gives them as: involute, revolute, convolute, and even conduplicate in the bud. The fact that he gives two species, closely related and difficult to distinguish, at the time the buds open (Salix nigra and S. amygdaloides), as having involute and revolute vernations, led me to take up the matter to see if a key for their identification from bud characters, could be constructed.

Not only did I find that they were not involute and revolute respectively; but that they were neither involute nor revolute, but both imbricate. On examining other species the same thing was found. The only exceptions to the true imbricate vernation found are represented in figures 3 and 4. The section Purpureae, on account of its tendency to have opposite rather than alternate leaves, often forms such decussate buds as are shown in figure 3. In Salix incana Schrenk, a species whose leaves at maturity have revolute margins, the leaves have a greater or less tendency to roll backwards in the bud. The most extreme case found is shown in figure 4. Others from the same twig could be shown where the leaves show only the slightest tendency to be revolute. If we may consider that

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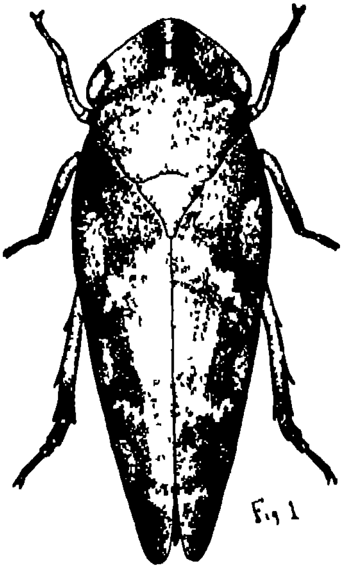
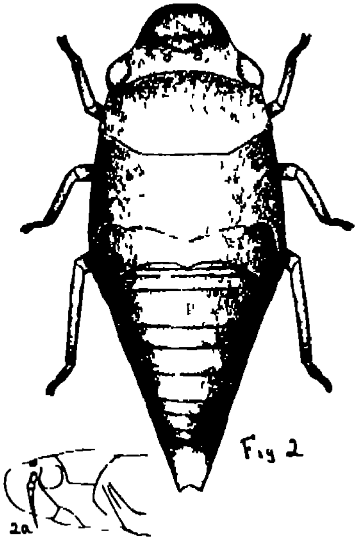
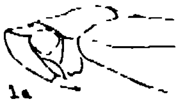
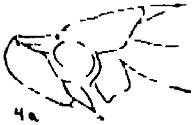
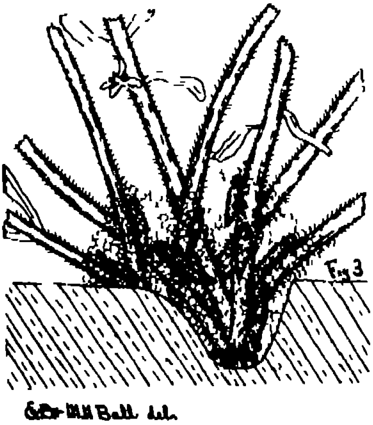
* Sargent. Silva of North America 9 96.

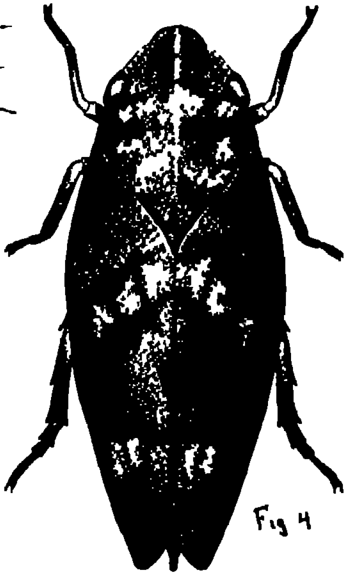




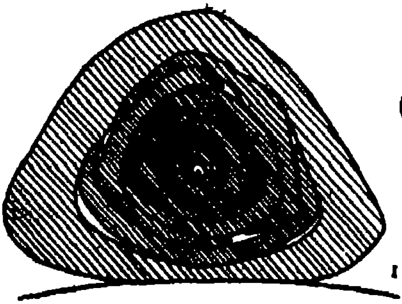








BALL ON APHROPHORA LARVAE



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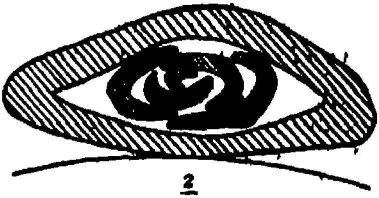

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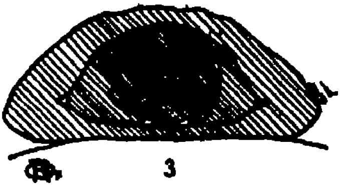

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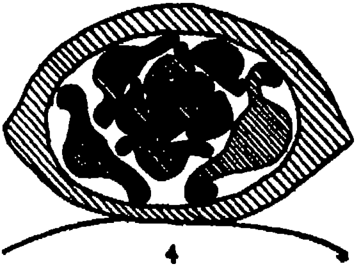

4

this backward turning is merely a character of the mature leaf manifesting itself in the bud it is evident that there is here no revolute vernation but that it is really imbricate

The other buds examined vary from the form represented in figure 1 where the whole interior of the bud is taken up with the closely packed leaves, to that shown in figure 2 where there are a few leaves with a great deal of wool

Species like Salix fragilis L whose leaves are glabrous when they unfold have buds like the former while species like Salix discolor Muhl., with leaves excessively wooly when they unfold, are like the latter As there are all intergradations between these two kinds of leaves, there is naturally a series of buds between these two as extremes. While further investigation is necessary before we would be warranted in declaring that the vernation of the whole genus is imbricate, yet the fact that specimens of thirty-four species and varieties, taken from thirteen of the nineteen sections given by Andersson in DeCandolle's prodromus, have their leaves imbricated in the buds would seem to establish a presumption in favor of such a view

The buds examined were soaked in 70 % alcohol and free-hand sections cut and mounted in balsam On account of scarcity of material, the buds of several species were not sectioned but dissected on the growing plant. Such are marked with an asterisk (*). As far as possible living material was taken, mostly from native plants. Those species not native were studied from specimens growing in the University Botanic Garden. In a few cases dried specimens were resorted to. About one hundred and twenty-five plants belonging to the following species and varieties were examined.

Salix nigra Marsh.
S. amygdaloides Anders.
S. triandra L.
*S. undulata Ehrh.
S lucida Muhl.
S. pentandra L.
S. fragilis L.
S. alba L.
S. alba vitellina (L.) Koch.
S babylonica x fragilis.
S. babylonica L.
S. babylonica japonica (Thumb) Anders.
S. interior Rowlee.
S. bebbiana Sarg.
S. discolor Muhl.
S. myrtilloides L.
S humilis Marsh.
S. tristis Ait.
S. sericea Marsh.
S. petiolaris Sm.
S. cordata Muhl.
*S. cordata x sericea.
S. cordata var. vestita Anders.
S. glaucophylla Bebb.
S adenophylla Hook.
*S daphnoides Vill.
S. smithiana acuminata (Sm) Anders.
S candida Fluegge.
S. incana Schrenk.
S purpurea L.
*S. rubra purpureoides Gen. & Godr.
*S. candicans Gen. & Godr.
*S. laurifolia Gen. & Godr.
*S. sieboldii Gen & Godr.

EXPLANATION OF THE FIGURES —Fig 1 Salix fragilis L Bausch and Lomb obj ⅚ oc 2
Fig 2 S discolor Muhl B & L obj ⅚ oc 2
Fig 3 S purpurea L B & L obj ⅚ oc 2
Fig 4 S incana Schrenk B & L obj ⅚ oc 1
The figures were drawn with an abbe camera lucida and reduced to 2-5 of their original size

OHIO REPTILES IN THE OHIO STATE UNIVERSITY ZOOLOGICAL MUSEUM.

MAX MORSE.

Fam. IGUANIDÆ.

Sceloporous undulatus undulatus (Latr.) Sugar Grove.

Fam. ANGUIDÆ.

Ophisaurus ventralis (Linn.). No. 57 has the following note in the accession catalogue:—"Donated by Dr. N. S. Townshend. Said by him to have been taken on the University farm."

Fam SCINCIDÆ.

Eumeces quinquelineatus (Linn.). Columbus.

Fam. COLUBRIDÆ.

Carphophiops amoenus (Say.) This specimen is marked *C. helenae* Kenn. The internasal scutae are wanting. The specimen is from Meigs Co. Another specimen is in the collection but without label.

Diadophis punctatus (L.) Sugar Grove

Heterodon platyrhinus Lat. Cedar Point. Both the spotted and the black forms occur on Cedar Point

Liopeltis vernalis (DeKay.). Sandusky and Columbus.

Zamenis constrictor (Linn.). Hocking County.

Coluber vulpinus (B. and G.). The range of the fox snake, as given by Cope (Rept. U. S. Nat. Mus., '98, p. 832) is "over the northwest of the Eastern district, not being known from east of Illinois***." Specimens are taken from Cedar Point and vicinity nearly every summer. Those in the collection are from Castalia and Cedar Point.

Coluber obsoletus obsoletus Say. Columbus.

Osceola doliata triangula (Boie) Columbus and London

Natrix fasciata fasciata (Linn.). Warren County.

Natrix fasciata sipedon (Linn.). This is the common "water snake" of central Ohio. Specimens are from Sandusky and Columbus.

Natrix fasciata erythrogaster (Shaw.) Put-in-Bay. Among the islands of Lake Erie this seems to be the prevailing form. One young *Natrix* was taken during the summer of 1900 which resembled *N. f. sipedon* L., but aside from this all other forms were *erythrogaster*. It may be possible that the young of these two sub-species are not distinquishable—the differences arising later.

Natrix leberis (Linn.). Columbus and Sandusky.

Natrix kirtlandii (Kenn.). New London and Sugar Grove.

Storeria dekayi (Holb.). Columbus.

Storeria occipitomaculata (Storer). Sugar Grove and Kent.

Eutaenia sirtalis sirtalis (Linn.) Columbus.

Eutaenia sirtalis ordinata (Linn.). Columbus.

Eutaenia sirtalis obscura Cope. Cedar Point and Columbus.

Fam. CROTALIDÆ.

Ancistrodon contortrix (Linn.). Sugar Grove and Knox County.

Sistrurus catenatus catenatus (Raf.). Urbana.

Fam. TRIONYCHIDÆ.

Aspidonectes spinifer (LeSueur). Columbus.

Fam. KINOSTERNIDÆ.

Aromochelys odoratus (Lat.). Columbus and Cedar Point. In May and June, numbers of this turtle have been taken in the sand on Cedar Point, while depositing their eggs.

Fam. EMYDIDÆ.

Graptemys geographicus (LeSueur.). Columbus, also taken at Sandusky.

Chrysemys marginata (Agassiz). Columbus and Cedar Point. The species *picta* does not occur in central Ohio—at least west of Licking Reservoir. One specimen has the normal three dorsal plates broken up into six which alternate with each other, three being on either side of the median line

Clemmys guttatus (Sch.) Columbus and Licking Reservoir.

Emydoidea blandingi Holb Columbus and Sandusky.

Terrapene carolina (Linn.). Very numerous at Sugar Grove. Found in sand on Cedar Point.

SUMMARY FOR REPTILES:—Families 8; genera 22; species 30.

A PRESERVING BOX FOR PLANTS.

EDO CLAASSEN.

As the time for botanists has arrived when they will depart for some time from their work at home and walk over fields and into the forests to collect plants and flowers new to them, I have thought it would be interesting and useful to describe a box in which they may preserve for several days, the collected plants and keep them from shriveling, particularly if the same are quite large, and exceed in size the usual small collecting box. As I had one made to order and know by experience the valuable service it did me, I do not hesitate to recommend it highly. It is well known that many druggists buy their glycerine and castor oil in five gallon cans, for which, when empty, they have no further use. The botanist, therefore, may go to such a druggist, procure two of the above cans, if possible of heavy tin and with flat sides, have the tinsmith take off their upper parts and solder the cans together, after having cut out of each of them a rectangular piece as long and wide as necessary to give room for a door and after having trimmed any inside edges. The door is then made from the two pieces cut out, (or from a new piece) with the addition of several strips of tin, so that it may overlap and close tightly, and of the necessary hinges and hasp to open and fasten the door. One of the original wire handles of the cans is fastened in a similar manner as before on the top of the box and the preserving box is ready for use, as soon as it had received two coatings of asphaltum varnish inside and two of paint outside. Any vessel of of suitable size and containing water should then be put into the box, which will furnish the moisture for the roots or the lower ends of the plants and at the same time for the air surrounding these. The dimensions of the box in question can easily be determined by the botanist himself, but for those not wishing to do so, I may be allowed to add, that the length of the box should be about twenty-five inches, the original width of the cans remaining unchanged. The door should commence at about three inches from the bottom, reach up to two or two and one-half inches from the top and have a width of six or six and one-half inches.

Cleveland, Ohio.

OHIO TUMBLEWEEDS.

JOHN H. SCHAFFNER.

Tumbleweeds are characteristic of wind-swept plains and dry prairies. As the forests are rapidly disappearing, the conditions in Ohio are becoming very favorable for the introduction and development of such forms of vegetation A few species are already abundant and some like Amaranthus graecizans appear to flourish better than on the prairies of the interior. The past summer a number of cornfields about Columbus were covered with very large tumbleweeds and during the winter a number of hedgerows were filled with them, presenting an appearance quite as striking as anything the writer has seen along this line

The following is a list of the Ohio plants which may develop as tumbleweeds Those with a question mark have not been seen by the writer to act as tumbleweeds and a few are given on the authority of Dr. W J Beal

ANNUAL TUMBLEWEEDS.

1. Cycloloma atriplicifolium (Spreng.) Coult.
2 Salsola tragus L.
3. Amaranthus graecizans L.
4. Lepidium apetalum Willd. Beal.
5. Trifolium procumbens L. Beal.
6. Onagra biennis (L.) Scop. Beal.

TUMBLE-GRASSES.

7. Panicum capillare L.
8. Panicum flexile (Gattg.) Scrib.
9. Eragrostis pectinacea (Mx.) Steudl.
10 Eragrostis trichodes (Nutt) Nash.
11 Eragrostis capillaris (L.) Nees ?
12. Eragrostis frankii Steud. ?
13. Eragrostis purshii Schrad. ?
14 Agrostis hyemalis (Walt.) B S. P.

PERENNIAL TUMBLEWEEDS

15. Baptisia tinctoria (L) R. Br.

MEETINGS OF THE BIOLOGICAL CLUB.

MAY MEETING.

The Biological Club met in Zoological Lecture Room May 6, 1901.

Professor Schaffner reported that the committee appointed to consider the disposition to make of exchanges, had had a meeting and appointed Professor Osborn to consider the matter further

Professor Laudacre gave a paper entitled A Study of Passalus Cornutus. He gave the more important conclusions he had arrived at, after an extended study of the muscular and skeletal systems of that beetle.

Mr. Griggs read a paper on Vernation in the Willows.

Moulds and other Fungi Injurious to Foods was the title of a paper given by Miss Mary Dresbach. She gave a list of fungi found on food products.

In discussing this paper Professor Schaffner said the moulds are of public interest and many important results may be expected from an extended study of them. Professor Kellerman said that moulds are an important factor to guard against in canning fruit. It would be a great step in advance if fruit could be canned and kept without its being cooked beforehand.

Miss Elma Perry gave a list of the edible fungi of Ohio. So far 200 species have been recorded and there are no doubt many yet to add.

Under the head of personal observations Prof. Kellerman showed some interesting variations in our common anemone. A paper on this subject appeared in the May number of THE OHIO NATURALIST.

JUNE MEETING.

The June meeting of the club was held in Zoological Lecture Room on the evening of the third.

The editor-in-chief of THE OHIO NATURALIST, Professor Schaffner, gave a financial statement for the year.

The Secretary read a communication from Professor Kellerman. This communication was concerned with the past and future of THE OHIO NATURALIST and an adjourned meeting was voted for its consideration. The following invitation was received from Professor W. D. Gibbs, Secretary of the Omega Chapter of the Society of Sigma Xi:

The Omega Chapter of the Society of Sigma Xi cordially invites the members of the Biological Club to be present at the final meeting of the Chapter, in the Physical Lecture Room, Saturday June 8th, at 11 o'clock a. m. to hear a lecture by Professor Charles F. Mabery on the subject: "The Petroleum Industry: Its Rapid Expansion and Future Promise."

Dr. Bownocker delivered an instructive paper on "Oil and Gas in Southeastern Ohio." The first oil well in that region was drilled about 1860 at Maxburg in Washington County. The wells in this region when first put down oftentimes yield 500 barrels or more daily but they soon decrease until the product of the same well may be only a few barrels each day. They are long-lived however and wells drilled in the Sixties are still producing. The oil in Southeastern Ohio has its origin in the various sands and therefore differs from that of Northwestern Ohio where all the oil is of limestone origin.

The speaker explained the nature of the country, especially in reference to the arches where practically all the oil is located.

H. S. Houghton not being present, Professor Landacre gave a short outline of the subject "A Study of the Muscular and Skeletal Structures in the Head of a 14 mm. Salamander."

A. F. Conradi read a short paper on the subject "A Study of the Cecidomyidae and their effects upon Vegetation."

The motion was made and carried that when we adjourn we adjourn to meet in the Zoological Lecture Room Friday evening, June 7th, at 4 o'clock, for the purpose of considering matters connected with the OHIO NATURALIST. JAMES S. HINE, Secretary.

With this issue THE OHIO NATURALIST completes its first year. The Editors to be chosen for 1901-2 will continue the Journal along the same lines and we trust that those interested in the natural history of Ohio, as well as others, will continue to give their encouragement and financial support.

A table of contents and a title-page of Vol. 1 will be sent out with the first number of Vol. 2. JOHN H. SCHAFFNER.

The Ohio Naturalist,

PUBLISHED BY

The Biological Club of the Ohio State University.

Volume II, NOVEMBER, 1901. No. 1.

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ANNOUNCEMENTS.

With this issue the OHIO NATURALIST begins its second volume. With brighter prospects before us we shall endeavor to make improvements over the first volume and to give our subscribers as good a publication as we possibly can. The subscription price remains the same as last year and we send out a large number of sample copies of this issue, with the desire that when you receive your copy, if you are not already a subscriber, you will conclude to become one and send us fifty cents and order the current volume sent to your address. A number of complete sets of Volume I., or any single number of that volume, are for sale at the regular subscription price. Address the OHIO NATURALIST, Ohio State University, Columbus, Ohio.

It is suggested that we introduce a correspondence department into our journal. To that end we announce that hereafter we shall be pleased to publish letters, or parts of letters, from our correspondents, whenever we consider such of sufficient general interest to our subscribers. Also, whenever desired, questions of importance sent in by correspondents will be answered in these columns. Members of the Advisory Board have promised to take charge of this department of the work.

GEOPHILOUS PLANTS OF OHIO, II.

FREDERICK J. TYLER.

The underground parts of plants are often of value as a means of characterization, and if the plant is a weed they become of the greatest importance; as the worst weeds are almost invariably geophytes. Very little information is given in most of the manuals upon this subject, and what is given is not always satisfactory.

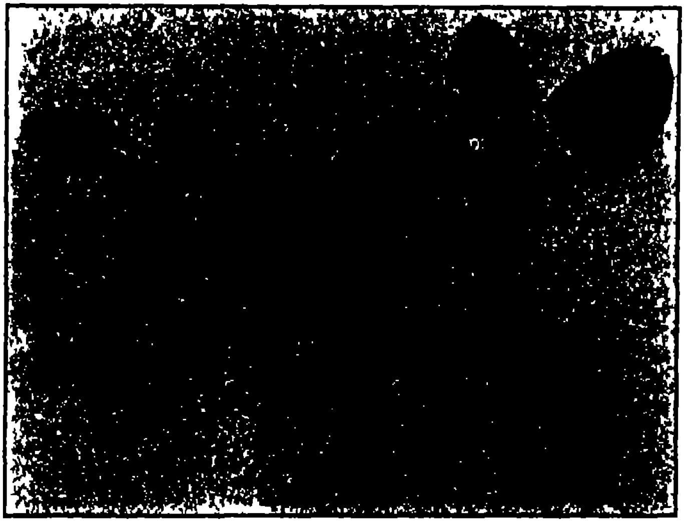


Figure 1

The terms used in describing geophytes are in every day use, except one—the crown. This term is applied to an herbaceous perennial which has but one upright stalk the first year This dies to the surface of the ground at the end of the season, but the short, upright, underground stem survives It then sends up lateral branches, which in some cases grow out several feet, in others only an inch or so before coming to the surface This branching, however, usually takes place in the Autumn and often the entire crown of lateral branches is formed some time before the parent plant is cut down by frost

The following notes, and others, to be given later, are intended to supplement the notes on Geophilous Plants of Ohio in the *O. S U Naturalist*, 1 21

Hypericum ascyron L A large woody root, surmounted by a close crown.

Gentiana andrewsii Griseb. An oblique rhizome, about 2 in. long, with numerous fleshy roots showing root contraction.

Corallorhiza odontorhiza (Willd.) Nutt. A small bulb, sending out the coralloid roots from the base.

Lespedeza frutescens (L.) Britton. A long woody tap root, surmounted by a close crown.

Lespedeza procumbens Michx. A close crownformer.

Lespedeza violacea (L.) Pers. A long tap-root and close crown, sending up from 10 to 20 annual shoots.

Lespedeza hirta (L.) Ell. A crownformer.

Meibomia pauciflora (Nutt.) Kuntze. A rhizomatous crown former. The rhizomes are slender, a foot or more in length, and branching. At the point of emergence there is usually a cluster of annual stems.

Thalictrum purpurascens L. A crownformer.

Coreopsis tripteris L. Rhizome composed of annual segments which are about 1 inch in length.

Epigaea repens L. Rhizomes long and slender, close to the surface of the ground.

Cypripedium acaule Ait. Rhizome 2 or 3 in. long, sending out numerous strong roots. The annual growth in length is very small. In one specimen examined the growth of four years amounted to only 6 lines.

Waldsteinia fragarioides (Michx.) Tratt. Rhizome 4 to 12 in. long, slender. Lateral branches numerous.

Plantago cordata Lam. An oblique rhizome of unique habit. The rhizomes of large plants are ½ to ¾ in. thick, and are solid for 2 or 3 in., but back of this the center rots away, leaving a shell which splits up to the base. In small plants it splits but once, forming a flat or slightly incurved ribbon. This becomes rounded, and seems to perform the function of a root. It, however, dies off gradually at the posterior parts. In fig. 1 the split portion is still united near the middle of one of the specimens, and a portion of the posterior end is dead. The root-like portion of the rhizome is much longer than the true rhizome.

Plantago rugelii Dec. A short, upright rhizome.

Plantago major L. A short, upright rhizome.

Lobelia syphilitica L. A close crownformer.

Geum canadense Jacq. A short, horizontal rhizome.

A specimen of the large Noctuid moth, Erebus odora Linn., was taken by members of the class in geology who were out for a field excursion on October 5th. So far as I am aware this is the first record for the capture of this species in Central Ohio. The specimen was said to be in excellent condition when taken, but was slightly rubbed and torn in bringing it in.

NOTES ON NESTING OF WARBLERS.

At Fort Ancient Ohio

Ray Densmore

During the latter part of May of the present year Mr Tyler and myself spent some time collecting in and around Fort Ancient, Warren County, Ohio The Fort is situated on the summit of a hill rurrounded by gullies 200 to 300 feet deep, with rather steep sides The Little Miami River runs by on the west

The sides of the gullies are springy and covered by enough bushes and small trees to make it an ideal resort for many of the warblers. The most common was the yellow-breasted chat. Nearly every clump of bushes was inhabited by one or more pairs of these well named birds. Several nests were found and two sets of four eggs each were taken One set is heavily marked with reddish blotches, the other is typical in coloration, but one egg is nearly a runt Oven birds were numerous, but no nests were found Kentucky warblers were abundant in the lower part of the gullies Three nests were found, one containing four eggs in an advanced stage of incubation, one containing three fresh eggs and a cow bird's egg and one nest just completed There was but little variation in the material used in construction, appearance or location of the nests The foundations were composed of tightly packed leaves, the bases of which were outward, and a lining of fine rootlets or in one a small amount of horse hair

A nest of the worm-eating warbler, containing six eggs, was found by Mr Tyler in a depression in the side of a bank under a bush The bird sat very close and allowed us to approach within three or four feet before she would leave the nest. We were able to identify [illegible] very certainly The species must have been rare in the locality, for no other specimens were seen during our trip The nest was composed of a foundation of leaves, loosely placed, and lined with fine rootlets and weed stems

The Louisiana water thrush was abundant along the streams One nest was found containing four young birds about a week old It had a foundation of weed stems and twigs and was lined with rootlets Its situation was in the side of a bank a few feet above the water

A Maryland yellow throat was heard on the flats of the Little Miami River, and two other warblers were seen that I was unable to identify, although one may have been the chestnut-sided

Perry, Lake County, Ohio

OHIO FUNGI EXSICCATI.

(With Reprint of Original Descriptions.)

W. A. KELLERMAN, Ohio State University

It is proposed to distribute exsiccata of the Ohio species of Fungi, issuing small fascicles from time to time as material may be available.

The original descriptions of all the species, or that given in connection with the first use of the binomial or technical designation, will be printed on the labels in addition to the data usually given. Complete synonomy will not be attempted.

The number of copies will be limited, but it is hoped that all mycologists who might be especially interested in the specimens, and those wishing to exchange, may be furnished with the fascicles as they appear.

Fascicle 1, containing Nos. 1 to 16, issued November 20, 1901, represents the following species:

1. Aecidium impatientis Schw., on Impatiens biflora Walt.
2. Aecidium porosum Peck, on Vicia americana Muhl.
3. Aecidium sambuci Schw., on Sambucus canadensis L.
4. Cintractia sorghi (Link), on cultivated Sorghum (S. vulgare Pers.)
5. Cintractia sorghi (Link), obtained by inoculation.
6. Cintractia sorghi (Link), on Broom Corn (S. vulgare Pers.)
7. Cintractia sorghi (Link), obtained by inoculation.
8. Peronospora arthuri Farl., on Onagra biennis (L.) Scop.
9. Phyllosticta asiminae E. & K., on Asimina triloba (L.) Dun.
10. Puccinia helianthi Schw., on Helianthus divaricatus L.
11. Puccinia helianthi Schw., on Helianthus mollis Lam.
12. Puccinia marie-wilsoni Clinton, on Claytonia virginica L.
13. Puccinia podophylli Schw., on Podophyllum peltatum L.
14. Puccinia smilacis Schw., on Smilax glauca Walt.
15. Septoria podophyllina Peck, on Podophyllum peltatum L.
16. Ustilago zeae (Beckm.) Ung., on Zea mays L.

Thanks are extended to the mycologists who have rendered advice and assistance, especially to Messrs. J. B. Ellis, J. C. Arthur, A. P. Morgan, and C. G. Lloyd. Acknowledgment for assistance in collecting will be found on the labels accompanying the several specimens.

The labels to the sixteen specimens of the first Fascicle are here reproduced.

1. Aecidium impatientis Schw.

On Impatiens biflora Walt
Columbus, Ohio June 1 1901
Coll W A Kellerman

Aecidium impatientis Sz A effusum magnum expallescens peridiis in centro sparsis crenatis sporidiis majoribus luteo fuscis simplicibus

Frequens Maio in foliis Impatientis maculatae Folia bullata reddit et macula lata lutescente in centro obscuriore inquinat I de Schweinitz Synopsis Fungorum Carolinae Superioris (excerpta) p 41 No 442 (1822)

2. Aecidium porosum Peck.

On Vicia americana Muhl
Lakeside Ottawa Co O May 17 1901
Coll W A Kellerman

Aecidium porosum Pk Spots none cups crowded deep seated broad wide mouthed occupying the whole lower surface of the leaf to which they give a porous appearance spores orange colored subangular 0008 001 inch in length Botanical Gazette 3 34 April 1878

3. Aecidium sambuci Schw.

On Sambucus canadensis L
Columbus, Ohio June 24 1901
Coll W A Kellerman

Aecidium sambuci Sz V maculaeforme magnum crassum folia contorquens aurantium exalbicans peridiis minutis sporidiisque simplicibus pallidis

In foliis inprimis ad venas majores et in petiolis Sambuci Canadensis Folia contorquet Color aurantio croceus peridia sparsa pulvere pallido lutescente albo L de Schweinitz Synopsis Fungorum Carolinae Superioris (excerpta) p 41 No 441 (1822)

Diagnosis ulterior sequens [sub nom Caeoma subgen Aecidium sambuciatum] C maculis intumescentibus saepe maximis (1 e 2 uncialibus) in petiolis pallescentibus Pseudoperidiis magnis crebris elevatis aurantiacis aut pallidis, margine fusco Sporidiis aurantiofulvis decolorantibus In foliis omnia multo minora—pseudoperidiis densim aggregatis J de Schweinitz, Synopsis Fungorum in America Boreali media degentium p 294 No 2897 (1834)

4. Cintractia sorghi (Link)

Sporisorium sorghi Link. Ustilago sorghi (Lk.) Pass.
On cultivated Sorghum (Sorghum vulgare Pers.)
Columbus, Ohio. September 15, 1900.
Coll. F. J. Tyler and O. E. Jennings.

"Sporisorium sorghi. Sp. acervis ovalibus, sporidiis globosis nigris germinum.

"Diagn. Substantia farinosa germinum Sorghi vulgaris primum rimis variis separatur ita ut semina hient. Tum sporidia oriuntur, usque dum tota compages interior germinis in sporidia dilapsa sit. Excrescunt quoque glumae in apicibus ramulorum paniculae, sporidia et partes floris mutilas continentes. Sub microscopio composito acervi compacti conspiciuntur, aqua adfusa non diffluentes, e quibus flocci simplices aut semel ramosi exeunt tenues septati, pauci tantum e singulo acervo. Sporidia compressis acervis in conspectum prodeunt exacte globosa sat magna, minora majoribus intermixta." H. F. Link in Linné Species Plantarum, 6² 86.

5. Cintractia sorghi (Link)

Sporisorium sorghi Link. Ustilago sorghi (Lk.) Pass.
On cultivated Sorghum (Sorghum vulgare Pers.)
Columbus, Ohio. November 10, 1900.
Coll. W. A. Kellerman.

Supplement to No. 4.
Obtained by inoculating the Sorghum seed with smut spores.

6. Cintractia sorghi (Link)

Sporisorium sorghi Link. Ustilago sorghi (Lk.) Pass.
On cultivated Broom Corn (Sorghum vulgare Pers.)
Columbus, Ohio. November 21, 1901.
Coll. W. A. Kellerman.

Supplement to No. 4.

7. Cintractia sorghi (Link)

Sporisorium sorghi Link. Ustilago sorghi (Lk.) Pass.
On cultivated Broom Corn (Sorghum vulgare Pers.)
Columbus, Ohio. November 21, 1901.

Supplement to No. 4.

Obtained by inoculating the Broom Corn seed with the Sorghum smut.

8. Peronospora arthuri Farl.

Conidial stage
On Onagra biennis (L) Scop
Columbus, Ohio June 5 1901
Coll W A Kellerman

P arthuri n sp Conidiophores rather short and rigid several times dichotomous Tips rather short and rigid Conidia broadly ellipsoidal obtuse 22 26 mmm by 19 mmm slightly violet colored Oospores large dark brown 34 42 mmm in diameter exospore covered with short blunt papillae W G Farlow Botanical Gazette 8 ,315 October 1883

9. Phyllosticta asiminae E. & K.

On Asimina triloba (L) Dunal
West Alexandria Preble Co Ohio July 4 1901
Coll W A Kellerman

Phyllosticta asiminae E & K Spots pale brownish of irregular shape (½ 1cm) bordered by a distinct dark raised line perithecia subglobose deeply immersed their apices barely visible on the upper surface of the leaf scattered 100 120 mmm diam spores yellowish with a slightly greenish tinge obovate 7 9 x 5 6 mmm The American Naturalist 17 1165 November, 1883

10. Puccinia helianthi Schw.

On Helianthus divaricatus L
Columbus Ohio October 10 1901
Coll W A Kellerman and F J Tyler

Puccinia helianthi Sz P minor orbicularis aggregata nigra sporidiis globoso ovalibus bilocularibus longissime pedicellatis

In plurimus Helianthis vulgaris Sporidia fusco lutea pedicello albo pellucido I de Schweinitz Synopsis Fungorum Carolinae Superioris (excerpta) p 47 No 495 (1822)

11. Puccinia helianthi Schw.

On Helianthus mollis Lam
Sandusky, Erie Co , Ohio September 17, 1901
Coll W. A Kellerman

Supplement to No 10

12. Puccinia marie-wilsoni Clinton.

Aecidial stage

Caeoma [Aecidium] claytoniatum Schw

On Claytonia virginica L

Arlington, Hancock Co , Ohio May 1, 1901.

Coll W A Kellerman

"C A Claytoniatum, L v S C fere simplex et sine macula, occupans tota folia Pseudoperidiis latis sparsis Sporidiis aurantiacis " L de Schweinitz, Synopsis Fungorum in America Boreali media degentium, p 294 No 2892 (1834)

13. Puccinia podophylli Schw.

Aecidial stage

Aecidium podophylli Schw

On Podophyllum peltatum L

New Plymouth, Vinton Co , Ohio May 10, 1901

Coll W A Kellerman

"Aecidium podophylli Sz A maximum orbiculare demum effusum flavo-aureum crassissimum, sporidiis subelevatis bilocularibus

"Folia et caules Podophylli saepe ingenti clade late longeque tegit, colore pulchro oculos alliciens " L de Schweinitz, Synopsis Fungorum Carolinae Superioris (excerpta), p 40 No 435 (1822)

14. Puccinia smilacis Schw.

Teleutospores only

On Smilax glauca Walt

Mineral Springs, Adams Co , Ohio Oct 30, 1900

Coll W A Kellerman

"Puccinia smilacis Sz P major confluens difformis et stellata nigro-fusca

"In Smilace rotundifolia omnia folia subexsiccata occupat " L de Schweinitz Synopsis Fungorum Carolinae Superioris (excerpta), p 46 No 494 (1822)

15. Septoria podophyllina Peck.

On Podophyllum peltatum L.

Columbus, Ohio June 9, 1901.

Coll. W. A. Kellerman.

"Septoria podophyllina Spots large, indefinite, reddish-brown , perithecia epiphyllous, few, clustered on or near the center of the spot, pallid or blackish, slightly prominent, collapsing when dry , spores filiform, variable in length, straight or slightly curved, 0008-0015 of an inch long " Chas H Peck Botanical Gazette, 4 170 June, 1879.

16. Ustilago zeae (Beckm.) Unger.

Lycoperdon zeae Beckm.
On Zea mays L.
Columbus, Ohio September 30, 1901
Coll. O. E. Jennings.

For full account of the synonomy with citations and notes, see J. C. Arthur, Botanical Gazette, **23**: 46, from which the following is taken:

To the translation by Johann Beckmann of Tillet's account of the species contained in the Royal Academy of Paris, 1776, where it is stated that, "Son dernier effet consiste à convertir cette excroissance en une poussière noirâtre et assez semblable à celle qui sort du lycoperdon ou vesse de loupe"—a foot note is added by the translator proposing the binomial designation, as follows:

"Meiner Meynung nach, ist das hier beschriebene Gewaechs allerdings ein Staubschwamm (Lycoperdon) und zwar eine Species parasitica, deren in Lin. Syst. Nat. schon drey befindlich sind, unter welchen also dieser Art, etwa unter dem Namen Lycoper zeae ein Platz anzuweisen waere." J. B., Hannoverisches Magazin, **6**: 1330.

HELPS IN ENTOMOLOGICAL STUDY.

Persons who are anxious to learn something of the habits of insects are often at a loss to select reliable books. Some recent additions to the list formerly available will make this task less difficult. The "Insect Book," by Dr. L. O. Howard, published by Doubleday, Page & Company, covers the groups of insects, exclusive of the butterflies, moths and beetles. It gives figures of a large number of species, some of them in natural colors, and while some of the figures fail to give all the detail necessary for the exact identification of species, most of them are very satisfactory. The keys, descriptions, typical life histories and directions for making collections, are written especially for the class of students who do not have access to specific collections, libraries or instruction.

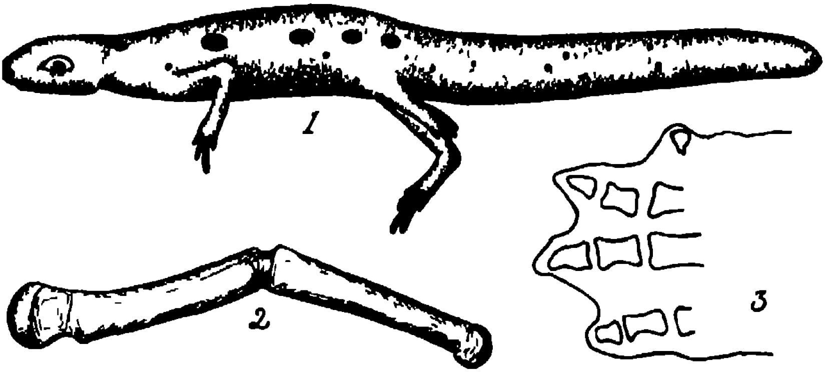
Another book of great interest at the present time (also by Dr. Howard) is entitled "Mosquitoes, How they Carry Disease, How they Live, How they are Classified, How they May be Destroyed." This deals in a remarkably clear and attractive manner with the habits of mosquitoes, their breeding grounds, the different species and their distribution, their relation to malaria and yellow fever, and the measures by which their numbers may be reduced. It furnishes incidentally a most excellent guide to the methods of life history study for aquatic insects. It is published by McClure, Phillips & Co.—H. O.

AN ABNORMAL SALAMANDER.

(Explanation of Figures)

E B WILLIAMSON

Mr John Russi during the past summer collected a newt, Diemyctelus viridescens, Raf , near Salem, Ohio, with a fifth foot growing from the dorsal surface of the left thigh, as shown in figure 1 The newt is a young one, 48 millimeters in length



The left femur is slightly longer than the right, and is shown much enlarged at figure 2 in anterior view Near its middle is a section of cartilege which allows of the femur being bent slightly in any direction Tendons from the fifth foot pass to the femur at this point Figure 3 shows a much enlarged drawing of the skeletal elements of the foot from dorsal view The salamander was kept alive for some time but so far as was seen made no use of and exercised no control over its extra foot I am indebted to Mr Russi for the privilege of examining this interesting specimen which he has donated to the Salem High School Museum.

THE SUMMER'S WORK AT SANDUSKY.

The work at the Lake Laboratory at Sandusky the past summer was very encouraging and indicates a steady growth in this branch of university work Aside from a number of instructors and students from the Departments of Botany and Zoology and Entomology of the University, there were in attendance representatives of a number of other Ohio colleges and high schools Courses in General Zoology, Botany, Entomology, Invertebrate Morphology, Embryology and Ornithology were given. Collecting trips to different portions of the bay, the lake shore, and the country adjacent to the laboratory were productive of many interesting objects for study, and reports on some of these will appear in later numbers of the NATURALIST. Special excursions to Castalia, Lakeside, Kelley's Island, Put-in-Bay and Green Island were not only enjoyable, but furnished much of profit in the way of collections One of the most appreciated feature was a visit to the U S Fish Commission Hatchery at Put-in-Bay, which furnished an opportunity to watch the plankton work done on the Shear Water under the direction of Prof. H B. Ward

A series of Friday afternoon lectures on biological problems, with titles, " Adaptation in Animal Life," "Aquatic Life," "Air-breathing Animals," "Some Phases of Evolution," " Some Problems in Applied Zoology," " Mimicry and Protective Resemblance in Nature," were given by Prof Osborn, and one on " Natural Selection," by Prof Landacre

THE MAXIMUM HEIGHT OF PLANTS III

JOHN H SCHAFFNER

During the past summer, the plants mentioned below were measured by the writer in northern Kansas A number of species grew far beyond the height mentioned in our manuals, although there was a very severe drought the entire summer The height given probably approaches the maximum in but few cases and a better growing season might produce a very noticable increase in size The measurements are given in comparison with those of Britton and Brown's Flora

	Britton	Measured
Polygonum lapathifolium L	3 ft	8 ft
Polygonum camporum Meisn	3	6¼
Froelichia floridana (Nutt) Moq	4	5
Chenopodium album L	10	12½
Anemone virginiana L (Ohio)	3	3⅓
Polanisia trachysperma T & G	1½	2¾
Cassia chamaecrista L	2½	5⅔
Astragalus carolinianus L	4	5½
Meibomia illinoensis (Gr) Ktz	4	7
Euphorbia dentata Michx	1¼	4
Euphorbia hexagona Nutt	1⅔	5
Euphorbia nutans Lag	2	3¼
Ceanothus ovatus Desf	.	4
Ammannia coccinea Rottb	1⅔	3
Gaura parviflora Dougl	5	12
Stenosiphon linifolium (Nutt) Britt	5	8
Onosmodium molle Michx	2	2½
Lycopus americanus Muhl	2	5
Mentha canadensis L	2½	3
Mimulus ringens L	3	3½
Lacinaria punctata (Hook.) Ktz	2½	3
Helianthus giganteus L (Ohio)	12	13
Coreopsis tripteris L (Ohio)	8	9
Carduus altissimus L	10	11

THE BIRDS OF CEDAR POINT, SANDUSKY.

R L BAIRD

The following list of birds I observed on Cedar Point within two miles of its extremity, from July 30th to August 20th, 1901, while a student at the O S U Lake Laboratory The list is not so complete as it might be I found the birds I did for the most part in short daily visits of about an hour each, generally in the afternoon One whole day I spent on the Point and two half days With one exception, that of the American Herring Gull, I think all the species named nest in the neighborhood of Cedar Point. The list ought to be much extended by going over the part nearer the mainland. I think at least fifteen or twenty more species ought to be found there as summer residents

I rode from Oberlin to Sandusky several times and the additional species I saw in Erie county I shall add in a list by themselves The most noticeable of these were the Bank Swallows They were in immense flocks along the road from Sandusky to Huron Sometimes as many as five hundred would alight on two lengths of telephone wire

The Long-billed Marsh Wrens were quite common all the time in the reeds to the west of the Point They were not singing, however, after August 5th The swamps upon the Point supplied many of the shore birds In a flock there were generally Bartramian, Pectoral, Spotted and Semipalmated Sandpipers, Semipalmated Plover, and Killdeers It was a common thing during the last week to hear the Coots in the marsh west of the Point Pied-billed Grebes were also tolerably common there The Bald Eagles were probably a pair which had a nest nearer the mainland The American Bittern I quote on the authority of Mr. Field, of Dennison College

I use the order of the latest A O U check-list The following abbreviations I add after each species C.—common, Tc tolerably common, Fe —few, figures indicate the exact number seen

CEDAR POINT LIST

6 Pied-billed Grebe, Podilymbus podiceps Tc
51*a* American Herring Gull, Larus argentatus smithsonianus 1
70 Common Tern, Sterna hirundo C
77 Black Tern, Hydrochelidon nigra surinamensis Fe
190 American Bittern, Botaurus lentiginosus Fe
191 Least Bittern, Ardetta exilis Fe
194 Great Blue Heron, Ardea herodias Tc
201 Green Heron, Ardea virescens Tc.
212 Virginia Rail, Rallus virginianus Tc
214. Sora, Porzana carolina Tc

221 American Coot, Fulica americana Tc
228 American Woodcock, Philohela minor. Fe
239 Pectoral Sandpiper, Tringa maculata Tc
246 Semipalmated Sandpiper, Ereunetes pusillus Fe.
248 Sanderling, Calidris arenaria Tc
261 Bartramian Sandpiper, Bartramia longicauda. Tc
263 Spotted Sandpiper, Actitis macularia C
273 Killdeer, Ægialitis vocifera Fe
274 Semipalmated Plover, Ægialitis semipalmata Tc
289 Bob-white, Colinus virginianus Fe
316 Mourning Dove, Zenaidura macroura Fe
331 Marsh Hawk, Circus hudsonius Fe
333 Cooper's Hawk, Accipiter cooperi Fe
352 Bald Eagle, Haliætus leucocephalus 2
364 American Osprey, Pandion haliaetus carolinensis 1
387 Yellow-billed Cuckoo, Coccyzus americanus Tc
388 Black-billed Cuckoo, Coccyzus erythrophthalmus Tc
390 Belted Kingfisher, Ceryle alcyon Tc
393 Hairy Woodpecker, Dryobates villosus Fe
394*c* Downy Woodpecker, Dryobates pubescens medianus Fe
406 Red-headed Woodpecker, Melanerpes erythrocephalus C
412*a* Northern Flicker, Colaptes auratus luteus Tc
423 Chimney Swift, Chaetura pelagica C
428 Ruby-throated Hummingbird, Trochilus colubris Fe
444 Kingbird, Tyrannus tyrannus C
452 Crested Flycatcher, Myiarchus crinitus Fe
461 Wood Pewee, Contopus virens C
465 Green-crested Flycatcher, Empidonax virescens Fe
477. Blue Jay Cyanocitta cristata C
488 American Crow, Corvus americanus Fe
494 Bobolink, Dolichonyx oryzivorus Tc
495 Cowbird, Molothrus ater Fe
498 Red-winged Blackbird, Agelaius phœniceus C
506 Orchard Oriole, Icterus spurius 1
507 Baltimore Oriole, Icterus galbula Tc
511*b* Bronzed Grackle, Quiscalus quiscula æneus C
529 American Goldfinch, Astragalinus tristis Tc
563 Field Sparrow, Spizella pusilla Fe
581 Song Sparrow, Melospiza melodia Tc
587 Towhee, Pipilo erythrophthalmus Fe
593 Cardinal, Cardinalis cardinalis Fe
598. Indigo Bunting, Cyanospiza cyanea. C
608. Scarlet Tanager, Piranga erythromelas Fe
611 Purple Martin, Progne subis C
613 Barn Swallow, Hirundo erythrogaster C
616 Bank Swallow, Clivicola riparia. C.
619 Cedar Waxwing, Ampelis cedrorum. C.

624	Red-eyed Vireo, Vireo olivaceous	C
627	Warbling Vireo, Vireo gilvus	Tc
636	Black and White Warbler, Mniotilta varia.	Fe
652	Yellow Warbler, Dendroica æstiva	C
681	Maryland Yellow-throat, Geothlypis trichas	Tc
683.	Yellow-breasted Chat, Icteria virens	Fe
687	American Redstart, Setophaga ruticilla	Fe
704	Catbird, Galeoscoptes carolinensis	Tc
705	Brown Thrasher, Harporhynchus rufus	Tc
718	Carolina Wren, Thryothorus ludovicianus	Fe
725.	Long-billed Marsh Wren, Cistothorus palustris	Tc
727	White-breasted Nuthatch, Sitta carolinensis	Fe
731	Tufted Titmouse, Parus bicolor	Fe
735	Chickadee, Parus atricapillus	Fe
755	Wood Thrush, Hylocichla mustelina	Fe
756	Wilson's Thrush, Hylocichla fuscescens	Fe
761	American Robin, Merula migratoria	Fe
766	Bluebird, Sialia sialis	Fe

ADDITIONAL ERIE COUNTY LIST

360	American Sparrow Hawk, Falco sparverius	Fe
373	Screech Owl, Megascops asio	Fe
501	Meadowlark, Sturnella magna	Fe
540	Vesper Sparrow, Poocætes gramineus	Tc
546	Grasshopper Sparrow, Ammodramus savannarum passerinus	Fe
560	Chipping Sparrow, Spizella socialis	Tc
617	Rough-winged Swallow, Stelgidopteryx serripennis	Tc.
622	Loggerhead Shrike, Lanius ludovicianus	Fe
721	House Wren, Troglodytes aedon	Tc

Oberlin, Ohio

MEETING OF THE BIOLOGICAL CLUB.

The Biological Club met in the Zoological lecture room on the evening of October 7th, at seven o'clock Professor Osborn presided over the meeting

The minutes of the June meeting were read and approved The evening was given to reports on personal work and observations of the summer

Professor Prosser reported that he had spent part of the summer in northern Ohio He visited points along the Cuyahoga and Rocky rivers, and studied the outcrops of the conglomerate at Boston Ledges, Little Mountain, Thompson Ledges, Nelson Ledges and at Sharon in Pennsylvania

Professor Kellerman collected a quantity of material in the Gauley Mountains of West Virginia, adding a number of plants to the published list of that state and securing a few that appear to be new to science. He also collected several hybrid oaks in Ohio, and some specimens of Cratægus, which Dr. Sargent of the Arnold Arboretum pronounces new species A number of species have been added to the published state list of Ohio

Professor Mills gave a report of the opening of a prehistoric mound in Ross County just outside the town of Chillicothe. A number of skeletons and some very valuable material were obtained for the collections of the Ohio Archæological and Historical Society.

Professor Schaffner spent the summer in Kansas He talked interestingly of a visit he made to the Pottawattamie Indian Reservation, and showed a series of photographs procured during a short stay among these interesting people Scientific investigations were made on several subjects, among which the following may be mentioned "The Self-pruning of Trees," "The Distribution of Cacti and Ferns in Kansas," "The Maximum Height of Plants," and "The Timber Conditions of Kansas"

Professor Landacre gave observations on the cocoon-spinning and egg-laying of the common garden spider

Mr Morse mentioned procuring a water snake with thirty-three young Also that the blowing viper, Heterodon platyrhinus, has some peculiar habits while in confinement One specimen if teased would go through a series of contortions and eventually come to rest lying on its back If all was quiet then it would soon take up its normal attitude, but if touched, or someone made a noise it was likely to turn over on its back again

Professor Cook spoke regarding the advance of plants in rock-quarries Monocotyls and willows are mostly brought in by water, while dicotyls are more often brought in by wind The monocotyls are the first to appear as a usual thing In the particular quarry in mind sycamores and willows were the only trees observed

Mr Bridwell spent the summer in Kansas, where most of his time was spent in collecting plants and insects The dry weather appeared to have its effect, as collecting was not as good as it had been in former years

Professor Osborn showed several photographs of tracks made by various animals on the sand of the lake beach at Sandusky Also other photographs of scientific interest, among which may be mentioned the fine glacial grooves of Kelly's Island, and the nest of a red-bird containing three young

A proposition to hold the meetings of the club in Orton Hall for the coming year was accepted

The November meeting is the annual meeting, at which new officers are elected, therefore a committee on nominations was appointed Professors Schaffner, Prosser and Landacre were appointed by the chair

JAMES S. HINE, *Secretary.*

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MEETING OF THE BIOLOGICAL CLUB.

November 4th, 1901

The Biological Club met in Orton Hall and was called to order by the president, Prof Osborn. As it is customary to elect new officers at the November meeting each year, the Nominating Committee presented the following names For president, Mr Mills, for vice-president, Mr. Morse, for secretary, Mr Tyler Prof Lazenby moved that the secretary be instructed to cast the unanimous ballot of the members present for the names proposed Carried Messrs J C Bridwell, M T Cook and Harvey Brugger were elected members

The retiring president, Prof. Osborn, presented a very interesting address, an abstract of which follows ·

SCOPE OF MODERN BIOLOGY

It has been the custom in this society, following a mandate of its constitution, for the president on retiring from the chair to give an address, and it is presumed that such an address will either bring to your attention the results of some special investigation, summarize the work in some field of research or outline the progress and problems with which biology has to do

When a year ago you were so kind as to honor me with this office, two things I think came especially to my mind ; one the success of the club particularly in the new enterprise of publishing a journal, the other the duty, honor and privilege of preparing an address for this occasion I presume you have all had the experience of contemplating some distance in the future a certain duty, debating the most suitable theme or method, and perhaps seen the time grow shorter and shorter with little real accomplishment If I were to enumerate the various topics that have come to my mind as suitable for this occasion it would exhaust quite a part of our time, if I could reproduce the current of thought that has flowed from time to time along the pathways of such topics, I am sure you would experience a weariness that I should regret to occasion

The parts of biology which we may make thoroughly our own are very few It may be profitable, therefore, occasionally to take a general survey of the field to see what its sphere of influence may be, what phases of life are being advanced by its discoveries or by the distribution of knowledge which follows It has seemed to me therefore that it would be appropriate this evening to attempt some such survey of biology, even though it be fragmentary and inadequate

For convenience in arrangement we may group this survey along the lines of practical applications of service to mankind, such as occur in medicine, agriculture and kindred industries, domestic and social life, and those which have to do with the acquisition of knowledge and with education

Applications of biology in medical science, in agriculture and in domestic life have in many cases assumed such intimate and essential character that we often look upon them as applied sciences more than in any other way

While biology has been the foundation of all rational systems of medicine and the constant servant of this most beneficent of human professions, the forms of its uses and the wide reach of its service have so increased in recent years that we almost have excuse in feeling that it is a modern acquisition

Could the ancient disciples of Æsculapius, with their views of physiology and anatomy, have seen the present scope of these subjects and the marvelous results in cure and control of diseases by the discoveries and applications in bacteriology, I doubt if they would have recognized it as any part of their biology. Still harder would it have been to appreciate the relations of malarial parasite, mosquito and man whereby a serious disease in the latter is occasioned Intimate relations of two kinds of life, as evidenced in the common parasites, must have been familiar from early times and their effects duly recognized, though their means of access and necessary life cycles were long misunderstood But such relations as are found to exist in the production of malaria, Texas fever and yellow fever have been so recently discovered that we count them among the triumphs of our modern science. Indeed the discovery of such a relationship may be considered as having been impossible until the methods of modern research and the basis of knowledge as to life conditions were acquired, and which made it possible to put the disjointed fragments together With the fragments thus related the riddle seems so simple that we wonder it was not solved before, but we must remember that it is knowledge which makes knowledge possible

These direct advantages in medical science are however but part of the great gift to modern methods of disease control, for the possibilities in the control of disease by sanitation, quarantine, vaccination, etc , and other methods are all based on biological data

In speaking of these recent acquisitions I would not disparage those important, in fact essential subjects of longer growth Modern medicine would be a fragile structure without its basis of comparative anatomy, physiology, materia medica and therapeutics, which have for long years furnished a basis for rational methods in surgery and medication

With all this knowledge at hand it is grievous to observe how general the delusion that disease may be eradicated by some much emblazoned nostrum, that some vile 'Indian compound' will be thought to have more virtue than the most accurately proportioned prescription which represents the best that modern science can do in the adaptation of a particular remedy to a particular ailment That the patent medicine business is a most gigantic fraud and curse will I believe be granted by every scientific man who has made himself acquainted with the subject Its immense profits are attested by the square miles of advertisements that disgrace the modern newspaper and magazine Fortunes made from the fortunes spent in such advertising, along with the commissions to the lesser dealers, are drawn from a credulous people who not only receive no value in return, but in most cases doubtless are actually injured as a result

That no student of biology can be deluded by such preposterous claims as characterize these compounds, in fact by any system of cure not based on sound biological principles, seems only a logical result of his training I do not recall ever seeing the name of a biologist among the host of those who sing the praises of some of these rotten compounds Mayors, congressmen, professors, clergymen and other presumably educated parties appear along with the host of those who fill this guilty list, a list that should be branded as a roll of dishonor I believe that educated men owe some measure of effort toward the abatement of this plague Naturally the medical profession is thought to be the rightful source for action, but among the uninformed any effort there is attributed to selfish motive. Certainly some measure of reform in this direction would be a service to mankind, and while no sensational crusade may be necessary, each one who knows enough of the laws of life to appreciate the monstrous folly of this business has it in his power to discourage it within the sphere of his individual influence at least. Newspapers are mostly choked off by the immense revenue derived from advertising, in fact I have known some which depended upon this as their main source of support, and have heard the candid statement that they could not have existed without it All the more honor therefore to the few, and there are a few, which absolutely refuse to allow such advertisements in their columns

That the modern physician must have a thorough knowledge of biology has become more and more apparent He has to deal with life, and life thus far at least cannot be rendered into mere mechanical, physical or chemical factors The activites of the human machine have much that must be studied from the basis of organic nature If we do not know all the factors or forces of life we do know that there is a complex or combination of forces radically different from any single force of inorganic nature Chemical affinity, physical attraction and repulsion, mechanical forces may furnish many aids, but the study of life activities must go still further To do this we must recognize the laws of organic life, the forces of growth and nutrition, of reproduction, of evolution, in fact a host of forces which have no counterpart in the inorganic world.

Modern agriculture and horticulture are so dependent on the principles of biology that to dissociate them does violence to thought Indeed this relation has existed through all recorded history, but in no period has the utility of biologic laws been so intimately blended with all the processes of cultivation.

The determination of the zones of greatest productivity for different crops, their soil requirements, the introduction and acclimatization of species belonging to other faunal or floral regions, the essentials of animal and plant nutrition, the control of disease or abatement of noxious forms of plant or animal, all these and more are embraced in the service of biologic science to agriculture in its various forms and thus to human interests.

Among special cases cited, but which cannot be printed here in detail, were various plant diseases, and particularly various insect pests, and the discoveries which have brought them more or less under control.

Aside from the sources of food supply, which come under the general term of agriculture, we derive many articles of diet from sources dependent on animal or plant life. The various fishery industries and oyster culture which have been so wonderfully promoted by biological investigations are excellent examples of the service of science to mankind. Game laws for the protection of certain forms of life of utility to man and the possible sources of food from various animals or plants not yet utilized may be mentioned here. Clothing comes in for its share, as in the methods for protection of silkworms, the saving of fur seals and other fur-bearing animals from extinction, and the use of various fibre plants. The successful growth of sponges, of pearls and many other articles of domestic comfort or ornament are connected in one way or another with biological problems, and their fullest development dependent on rational measures possible when the biological conditions are known

In another way these questions enter into our social and commercial life The rights of property in the migrant or semi-migrant forms of life have biologic as well as legal basis and some quite peculiar legal decisions would doubtless have been very different had the biology been appreciated. The classification of turtles as 'vermin' since they are neither fish nor fowl may be given as a case in point Equally absurd and sometimes more disastrous are some of the rulings by customs officers whose knowledge of biology was doubtless derived from a greek lexicon or some equally good authority Such quarantine restrictions as have been imposed upon certain products by some governments show total lack of knowledge as to the possible conditions of injurious transportation or else the misapplication of them to serve some special end.

The exclusion of American pork and American fruits from certain countries, the controversy over the fur seals in Alaska, the inconsistent laws of states or nations regarding game, are some of the instances where it is evident that the law-making power and the agents of diplomacy need to be re enforced with definite biological knowledge

But there is another phase quite distinct from the purely utilitarian Biological science opens up to us the facts of life and solves some of the questions of the greatest interest to mankind What is life? What its origin? What are the factors that have controlled its development and the wonderful complexities which we observe in its distribution and adaptations? Are the forces that operate in the living organism merely physical, mechanical and chemical or are there activities inherent in life itself or that operate only in the presence of the life containing complex? Certainly, in no other branch of science are there problems more inviting In no other has present knowledge given greater inspiration or greater intellectual service to mankind

The field for acquisition of knowledge widens with each new discovery We no sooner gain foothold in some hitherto unexplored realm than we become conscious that beyond this lie still other realms, knowledge of which has been dependent on knowledge of the routes by which they may be reached.

Thus structure must be known to understand function, and function known enables us to interpret structure. Evolution could not be demonstrated until after there had been gathered the necessary materials to show relations of different organisms, past and present But, evolution known, and vast arrays of structure become intelligible Without the knowledge of organic distribution no laws of distribution could be framed, but without the explanation of distribution afforded by evolution the facts are an unmeaning puzzle So, too, without an effort at systematic arrangement of plant and animal forms no fundamental law of relationship could have been discovered, but given a law of relationship and systematic biology assumes a totally different aspect. Recognition of the multitudinous forms of nature are but one step then in the presentation of the vast concourse in their proper relations

No doubt biologists will persist till every form of life has been adequately described and some means of designating it adopted So much may be expected from the enthusiasm of the systematist Some centuries of effort must, of course, be expected to elapse before the task is done But it is evident that the modern biology is much less concerned in the mere recognition of these innumerable forms of life, these remotest expressions of the force of evolution, than in the gaining of some adequate conception of their relations, the forces of adaptation that have fitted them for their particular niche in the realm of nature, their relation to the other organisms with which they are associated and which constitute for them a source of support or a menace to existence That is, modern biology concerns itself not only with the elements of structure in the organism, with the means it has of performing its varied functions with the aggregate of individuals which constitute its species, but goes on to its relations to all the influences and forces which have made it what it is and which sustain its specific existence Less than this is too narrow a view of the province of biology. Here is unlimited scope for the student who pursues knowledge for love of knowledge

As an inspiration to the general student the field of biology has always held an important place, and in these modern times its fascination is as potent as ever Men have attacked the problems of life from many different viewpoints with greatly different aim and great difference in preparation and method in their work. Some of these have sought merely for inspiration for literary effort, but so far as their records have been exact and truthful they are contributions to science, when mixed with "vain imaginings" they become literature and not science, although their right to rank here may depend on literary merit Every gradation from pure fiction to pure science may be found and every grade of literary merit as well White and Goldsmith, Wood and Figuier, Kipling and Seton-Thompson, with many others that could be cited, illustrate this wide divergence among writers who have written to the entertainment and the greater or less profit of their readers The value of such works as these is rather hard to estimate, especially from the scientific standpoint and particularly when one is under the hallucination of a beautiful piece of literary creation They furnish entertainment and cultivate imagination, some of them stimulate observation and awaken an interest in nature, but unfortunately many of them contain so much that is inexact or erroneous that they may sadly encumber the minds of their readers

But I would like to call attention here to what appears to me a fundamental condition of scientific work and thereby a necessary result of scientific training Science is naught if not exact. Accurate observation, accurate record, accurate deduction from data, all of which may be reduced to simple, plain honesty Anything else is error, not science It is not that "honesty is the best policy," but that in science honesty is the only possible policy Hence, scientific training should give to every student this one at least of the cardinal virtues, and we may claim with justice this advantage as one of the results to be derived from pursuing scientific studies. In fact the relation of science and biological science, no less than any other, to general schemes of education, has been one of its most important contributions to humanity

Biology has influenced modern education both in the matter taught and the method of its presentation It has gone farther and farther into the mysteries of nature and opened up wider fields of knowledge It has insisted that the student should be trained not only in the facts and the accurate interpretation of facts, but in the methods by which facts may be obtained, thus providing for the continuous growth of the substance from which its principles may be verified and definite conclusions reached

In recent years there has been a wide demand for the more general distribution of knowledge of nature, and "nature study" has had a prominent place in the discussions of educators. I must confess to some fear for the outcome of well meant efforts to crowd such studies into the hands of unprepared teachers, though surely no one could wish more heartily for a wider extension of such work well done It is encouraging to note steady progress in this line and we should be content not to push ahead faster than conditions will warrant.

Our science is an evergrowing one, and I wish to mention briefly some of the conditions of biological research and the conditions essential to its successful prosecution. The time has passed when it is possible for the isolated individual to accomplish much of anything of value in the growth of science Such instances as the cobbler naturalist can not well be repeated under present conditions, and biological workers must expect that some part at least of their time is spent where libraries, museums and scientific workers are to be found. I recall meeting some years ago in an obscure little village, with a young man who was following a trade, but whose ardent love for nature had brought him to take up the study of a certain group of insects, and in this group he had conceived the idea of preparing a work covering the geographical distribution for the world With scarcely the beginning of a library, with no access to general collections, apparently with no conception of the stupendous nature of the task he was so ambitiously undertaking, there was perhaps little danger of his discovering the hopelessness of his case He doubtless gained much pleasure and individual profit in the quest, but for the progress of science, how futile such attempts Isolated work is often necessary, often the only way in which certain data can be secured, but if isolation be permanent, if it means to be cut off from the records of what has already been done in one's line of study, progress is painfully slow and results of little value Access then to the world's storehouses of knowledge, to libraries and museums where one may determine the conditious of progress on any given problem is an imperative condition to satisfactory research

Another condition almost as imperative is time for extended and consecutive work There are comparatively few places where, after passing the stages of preparation, one may have the opportunity to give uninterrupted time to pure research, but fortunately such opportunities are increasing

Another factor is necessary equipment, a condition varying indefinitely with the problem undertaken. Studies of some of the simpler processes of life may be successfully carried on with barely any apparatus whatever, while others require the most costly and complex of machinery Deep sea investigations, for example, are possible only with a suitable vessel and elaborate apparatus for dredging and other operations, and such expeditions as that of the Challenger, the Blake, the Albatross and others involve such vast outlays that only the liberality of nations or of the very wealthy render them possible.

However, the modest student without a dollar to invest in these expensive undertakings may have the opportunity to work as diligently and effectively as any So, too, the costlv equipments of marine stations, of universities, of national and state museums are open to every earnest worker.

Still another condition related to the best effort in research is a satisfactory outlet for publication. Probably no investigator enters on an elaborate extended research without the expectation that such results as he may obtain, especially such as are novel and important to the growth of science, shall at some time be given a public hearing and a permanent record in the annals of science However much this ambition may be overworked and abused, it must be considered the logical and legitimate outcome of research, valuable as an incentive to work, essential to the progress of science.

The output of scientific laboratories is always pressing hard upon the organs of publication, and though we have numerous periodicals open to all, many society proceedings and transactions devoted to their membership, university bulletins intended primarily for the staff and students of each institution, still adequate publication facilities are often wanting Especially is this true regarding the suitable illustration of papers which depend largely on plates or drawings for the elucidation of the text Our own modest effort in THE NATURALIST is an attempt to meet one phase of this demand, but you all appreciate, I think, that it is insufficient for the needs of our own institution Some of the more extended papers resulting from the work of either students or faculty must suffer oblivion, delay or inadequate presentation Evidently a publication fund is one of our pressing needs

Opportunities for research have been much increased within recent years, and now it is possible for one to look forward with some assurance to a career in research pure and simple if that is his desire As many of those present doubtless anticipate such career, it may not be amiss to mention some of the opportunities that now present Positions in connection with universities and colleges now as for a long time past offer some of the most available openings Fellowships, and positions as assistants with comparatively light duties with expectation that the holder will devote himself to investigation that will advance his branch of science are offered in many places and their value is shown by the numerous candidates for each position Many government positions in Department of Agriculture, Geological Survey and Fish Commission demand a high degree of training and offer exceptional opportunities for research

The first few years following graduation are golden days of opportunity in the way of research For the majority, perhaps, these are the days when the greatest amount of original study may be possible and under conditions favoring the greatest productivity As time passes and duties and responsibilities increase the opportunity for uninterrupted work grows less and less. Of course original work should follow necessary preparation but can not be postponed indefinitely, in hopes of a more favorable season, if the individual hopes to accomplish anything of value in his chosen science. Too early publication however is to be discouraged. Most good things will keep for a time at least, and the opportunity to test and verify investigations before publishing is desirable. It is unwise to attempt to harvest a crop of glory, in scientific fields at least, before the seed has had time to germinate. The extremes of too hasty publication and indefinite delay are both to be avoided

But this disjointed address must be brought to a close, I have indulged in a medley rather than pursuing a connected theme, but it has been in my mind to show how the influence of modern biology has been felt in every phase of human life and modified every phase of human thought It touches history and illumines it as a record of human activities, the modifications and adaptations of the most dominant organism of earth It touches language and infuses it with life as the highest evolution of all means of communication among animals It enters the sphere of human relations and we see society, government, law, as the most complex expression of forces operative all along the line of organic life

We may gain inspiration in our work from the thought that our field of labor gives opportunity for the highest service in the advancement of human interests and the intellectual uplift of the race

The club extended Prof. Osborn a vote of thanks for his valuable address.

F J TYLER, *Secretary*

The Ohio State Academy of Science held its eleventh annual meeting at the Ohio State University in this city on November 29th and 30th. Between thirty and forty papers were given and the attendance was considerably above the average. On the evening of the 29th a joint meeting was held with the Modern Language Association of Ohio, which held its annual session at the University on the dates mentioned above The committee arranged an interesting and appropriate program for the evening and a large and appreciative audience responded. The Academy meetings have been held heretofore during the Christmas vacation, therefore holding it at this time was an experiment, but judging from the program, attendance, and enthusiasm manifested, the meeting this year may be said to be one of the best the society has ever held

It is of more than ordinary interest to be able to record the taking of specimens of the European ruff, Pavonc lla pugnax (Linn.) in Ohio Two male specimens are in the Dr Jasper collection at the Ohio State University, one taken April 28th, 1879, at Columbus, the other November 19th, 1872, at the Licking Reservoir.

FIFTY ADDITIONS TO THE CATALOGUE OF OHIO PLANTS.

W. A KELLERMAN.

The plants listed below have been found growing in the State without cultivation. A large number of them are adventive species but not hitherto recorded in the Ohio list. Three of the names occurred in the old lists and were noted in the Catalogue of 1893 by Kellerman and Werner, but were discarded in the Fourth State Catalogue, published in 1899 These here referred to and which are below restored to the Ohio list, are Nos 683 *a*, 1423 *b*, and 1990½ *a*. No. 893 *a* was included in L. D Stair's list of Railway Weeds All the others are wholly new to the listed flora. While several persons have contributed to this increase, special thanks are due to Mr. Otto Hacker, who formerly as well as at present, contributed largely to a fuller knowledge of the State flora Mr Hacker has furnished specimens of all the species credited to him below and these are deposited in the State Herbarium The rich field for adventive species in the region of Painesville may be understood when it is stated that the extensive and long-established nursery grounds of Storrs and Harrison are located at this place.

1 *a* Botrychium lunaria (L.) Sw Moonwort. Painesville, Lake Co Otto Hacker

201 *a* Apera spica-venti (L.) Beauv Silky Bent-grass Wildstraw Painesville, Lake Co Otto Hacker

201 *b* Aira caryophyllea L. Silvery Hair-grass. Rarely escaped Painesville, Lake Co Otto Hacker

253 *a*. Festuca myuros L. Rat's-tail Fescue-grass Painesville, Lake Co Otto Hacker

272 *a* Hordeum sativum Jessen Common Barley Occasionally escaped.

272 *b* Hordeum distichum L Two-rowed Barley. Rarely escaped Painesville, Lake Co Otto Hacker

470 *a* Lemna cyclostasa (Ell.) Chev (L. valdiviana Phil.) Valdivia Duckweed. Richmond, Lake Co Otto Hacker

557 *a* Gemmingia chinensis (L.) Kuntze Blackberry Lily Escaped. Franklin Co. J H Schaffner

557 *b* Crocus vernus All. Crocus Escaped Painesville, Lake Co Otto Hacker

568 *a* Limnorchis hyperborea (L.) Rydb (Habenaria hyperborea (L.) R. Br.) Canton. Mrs. Theano W Case

670 *a* Quercus alexanderi Britton. Alexander's Oak "Ohio," N. L. Britton, Manual of Flora, 336 This was formerly confused with, or included in Q acuminata, and like the latter is not uncommon in Ohio

683 *a*. Urtica urens L Small Nettle Painesville, Lake Co Otto Hacker.

754 *a* Acnida tamariscina prostrata Uline and Bray Painesville, Lake Co Otto Hacker

762 *a* Portulaca grandiflora Hook Garden Portulaca Sun Plant Escaped, Roadsides St Marys, Auglaize Co A Wetzstein

775 *a* Lychnis vesicaria L Lychnis Escaped Painesville, Lake Co Otto Hacker

886 *a* Fumaria parviflora Lam Small Fumitory Painesville, Lake Co Otto Hacker

893 *a*. Sisymbrium altissimum L Tall Sisymbrium L D Stair in List of Railroad Weeds Painesville, Lake Co Otto Hacker

894 *a*. Myagrum perfoliatum L Myagrum Painesville, Lake Co Otto Hacker.

921 *a* Camelina microcarpa Andrz Small-fruited False-flax Painesville, Lake Co Otto Hacker

984 *a* Rubus neglectus Peck Purple Wild Raspberry Painesville, Lake Co Otto Hacker

985 *a* Rubus phoenicolasius Maxim Japan Wineberry Escaped from cultivation, comes freely from seed, and propagates by tips Painesville, Lake Co Otto Hacker

1004 *a* Potentilla pumila Poir Dwarf Five-finger. Painesville, Lake Co Otto Hacker

1026 *b* Sorbus aucuparia L European Mountain Ash Escaped Painesville, Lake Co Otto Hacker

1051 *a* Prunus mahaleb L Mahaleb Perfumed Cherry Columbus, Franklin Co W A Kellerman Painesville, Lake Co Otto Hacker

1054 *a* Acuan illinoensis (Mx) Kuntze (Desmanthus brachylobus Benth) Illinois Mimosa New Richmond, Clermont Co A D Selby

1071 *a* Trifolium dubium Sibth Least Hop-Clover Painesville, Lake Co Otto Hacker.

1091 *a* Coronilla varia L Coronilla, Axseed, Axwort Painesville, Lake Co Otto Hacker

1122 *a* Vicia angustifolia Roth Smaller Common Vetch Painesville, Lake Co. Otto Hacker

1171 *a* Euphorbia cuphosperma (Englem) Boiss Warty Spurge. Painesville, Lake Co Otto Hacker

1195 *a* Euonymus europaeus L Spindle-tree Escaped Painesville, Lake Co Otto Hacker

1265 *a* Viola odorata L English or Sweet Violet. Escaped Painesville, Lake Co Otto Hacker

1301 *b* Kneiffia linearis (Mx) Spach Narrow-leaf Sundrops Painesville, Lake Co. Otto Hacker

1[illegible] *b* Spigelia marylandica L Indian Pink or Carolina Pink Fl M V A. P Morgan North Madison, Lake Co D W. Talcott.

1502 *a* Asperugo procumbens L German Madwort Catchweed Painesville, Lake Co Otto Hacker.

1534 *a* Scutellaria parvula ambigua Fernald "Ohio," Nuttall Greene Co., E L Moseley, Montgomery Co, W U Young, Franklin Co, E. E Bogue, Gallia Co, J W Davis

1556 *a* Salvia lanceolata Willd Lance-leaf Sage By roadside near Columbus W A Kellerman

1586 *a* Mentha longifolia (L) Huds Horse Mint Painesville, Lake Co Otto Hacker

1600 *a* Physalis francheti Mast Chinese Lantern Plant Escaped Painesville, Lake Co D W Talcott

1609½ *a* Datura metel L Entire-leaf Thorn-apple Escaped. Painesville, Lake Co Otto Hacker

1611 *b* Kickxia spuria (L) Dumort (Elatinoides spuria Wettst) Painesville, Lake Co Otto Hacker

1690 *a* Diodia teres Walt Rough Button-weed Painesville, Lake Co Otto Hacker

1702 *a* Asperula hexaphylla All Asperula Escaped Painesville, Lake Co Otto Hacker

1712 *a* Viburnum lantana L Wayfaring Tree Escaped Painesville, Lake Co Otto Hacker

1732 *a* Valeriana officinalis L Garden Valerian Escaped Painesville, Lake Co Otto Hacker

1756 *a* Arnoseris minima (L) Dumort Lamb Succory Painesville, Lake Co Otto Hacker

1756 *b* Hypochaeris glabra L Smooth Cat's-ear Painesville, Lake Co Otto Hacker

1766 *c* Lactuca virosa L Strong-scented Lettuce Confused with L scariola according to Britton, being the commoner of the two species (A D Selby, Meeting Ohio Academy of Science, November, 1901)

1775 *a* Hieracium pilosella L Mouse-ear Hawkweed Painesville, Lake Co Otto Hacker

1990½ *a* Tanacetum vulgare crispum DC Tansy Painesville, Lake Co Otto Hacker.

BOTANICAL CORRESPONDENCE, NOTES AND NEWS FOR AMATEURS, I.

Conducted by W A KELLERMAN

Item 1. It has been asked how many species of plants occur in Ohio. Only a guess can at present be made In the Catalogue of Ohio Plants, by Kellerman and Werner, prepared in 1893, there were listed 1,925 Spermatophytes, 68 Pteridophytes, 335 Bryophytes, and 1,400 Thallephytes The Fourth Catalogue, by the writer, published in 1899, gave 2,025 species of Pteridophytes and Spermatophytes. While many additions to the previous list were included, very many species formerly reported were excluded because unauthenticated by herbarium specimens, and others were undoubtedly extra-limital for Ohio. Two Annual Supplements to this catalogue have been issued, bringing the number of species of the vascular plants, nearly all authenticated, up to about 2,150. The mosses, the higher fungi and the lichens have been listed with some degree of fullness, but most of the other lower plants have been very incompletely placed on record, though large collections, only partially worked up as yet, are now in the herbarium of the State University.

Item 2. Miss Ruth E. Brockett, of Rio Grande, Gallia County, Ohio, has found the Showy Skullcap, Scutellaria serrata Andr., previously unreported for this State. The distribution, as given in Britton's Flora, is New York and Pennsylvania to North Carolina, Illinois and Kentucky. In the Rio Grande region many interesting or new plants for the Ohio list have hitherto been detected by Miss Brockett, as the Fringe Tree (Chionanthus virginica), the Purplish Buckeye (Aesculus octandra hybrida), and others too numerous to mention.

Item 3. An interesting and suggestive study has been published by Herman Dingler (Muenchen) on the organs for wind-dispersal (flug-organe) in the Vegetable Kingdom. The title of the book is "Ein Beitrag zur Physiologie der passiven Bewegungen im Pflanzenreich." After describing fully the mechanics involved, and the methods of investigation, the author enumerates the *Chief Types* of the flight organs as follows (prefixing to the word "flyer" the descriptive words, 1, dust, 2, granule, 3, bubble, 4, hair, 5, pan; 6, umbrella, 7, sail, 8, disk-twist; 9, barrel-twist, 10, plain-twist, 11, screw, and 12, screw-twist.)

I. Group

1. **Staubflieger,** e. g. Micrococcus, Puffball, Spores of Mosses, Pollen.
2. **Kornchenflieger,** e. g. Poppy, Species of the Pink Family, Orobanchaceæ.
3. **Blasenflieger,** e. g. Ironwood (Ostrya), Valerianella, Rhus cotinus.
4. **Haarflieger,** e. g. many Bromeliaceæ, Pitcairnia, etc.
5. **Napfflieger,** e. g. Wafer Ash (Ptelea trifoliata), Cochleospermum.
6. **Schirmflieger,** e. g. the Compositæ, Milkweeds (Asclepiadaceæ), Willows.

II. Group

7. **Segelflieger,** e. g. Cross vine and seeds of other Bignoniaceæ.

III. Group

8. **Scheibendrehflieger,** e. g. flattened seeds of the Iris, and Lily families.
9. **Walzendrehflieger,** e. g. Silver bell (Halesia), Knotweed (Polygonum), etc.
10. **Plattendrehflieger,** e. g. Tecoma stans. (The Ailanthus type.)

IV. Group

11 Schraubenflieger, e g. Maples, genera of Coniferæ, Sapindaceæ, etc.

V Group

12 Schraubendrehflieger, e. g fruit of Liriodendron tulipifera

Item 4. The recent death of Thomas Meehan, horticulturist and botanist, removes from the list of active American workers one whose numerous, accurate and original observations contributed greatly to the advancement of botanical science.

NOTE AND CORRECTION TO OHIO FUNGI EXSICCATI

W. A KELLERMAN

A critical inspection of the nomenclature used for the first Fascicle of the Ohio Fungi might seem to warrant the conclusion that the judgment of more recent workers is sometimes ignored and that a too conservative course has been adopted But it should be remembered that the main purpose is to furnish Ohio material accompanied by names (occasionally synonyms) that were undoubtedly applied to the species represented I have preferred to use for the Rust on Sunflower, Puccinia helianthi, rather than P tanaceti – recent work on other species suggesting that with this also when fully studied, a physiological distinction may supplement the too insignificant morphological difference Again, I have used Aecidium album, which Clinton applied to the first stage of the Uredine found on Vicia, not ignorant of the fact that Dietel gives this as a stage of Uromyces albus—but should not this first be substantiated by cultures? It is to be added that through inadvertancy Peck's later name (Aecidium porosum) was used, hence here follows a corrected label with both Clinton's and Peck's descriptions

2. Aecidium album Clinton.

Aecidium porosum Peck.

On Vicia americana Muhl.

Lakeside, Ottawa Co., O. May 17, 1901.

Coll. W A Kellerman.

"Aecidium album Clinton, spots none , peridia scattered, short, white, the margin subentire ; spores subglobose, white, about .0008 inches in diameter" Report on the State Museum, State of New York, 26 78 1873

"Aecidium porosum, Pk Spots none ; cups crowded, deep-seated, broad, wide-mouthed, occupying the whole lower surface of the leaf to which they give a porous appearance , spores orange-colored, subangular, .0008-.001 inch in length" Botanical Gazette, 3:34 April, 1878

NOTES OF TRAVEL IN PORTO RICO.

ROBERT F GRIGGS

By its configuration, Porto Rico is divided into two parts very distinct from each other in almost every respect and of primary importance in all the affairs of the island. The north side, which comprises about two-thirds of the total area, is kept constantly wet with almost daily rains. On the south it has been known not to rain for a whole year in some places. On the north side grows an abundance of luxuriant, tropical vegetation; on the south in many localities are barren hills covered only with scrub brush. But throughout the island there is great local variation in all the climatic and physical conditions.

Along most of the north side there stretches a low, coast plain, out of which rise numberless, small, steep hills. This plain, everywhere well watered, is in most places very fertile, but in the vicinity of Vega Baja it becomes a sandy waste. This sand desert is one of the most peculiar places it has ever been my fortune to visit. There is no grass (turf-making grass is almost unknown in the tropics), neither are there large trees. Everywhere are low bushes not much more than ten feet tall. The sand beneath them is bare in many places, but is covered in others with various forms of herbage, most of which, instead of being composed of desert forms, as would be expected, is made up of the most typical water-loving plants, among which, Sphagnum (two species) and Utricularia are noteworthy. Imagine, if you can, a sphagnum bog shading into loose sand in a distance of only ten feet with no change in level. The explanation of this peculiar fact is, however, not hard to find. The rainfall is so copious that wherever there is any means of holding it, the hydrophytes take hold and spread, themselves acting as water holders when once started, while in other places the water quickly soaks into the sand and leaves it as dry as ever.

The plain on which this sand desert is located is separated in most places from the sea by low hills. It is very level and was probably once covered with water out of which projected many rocky islands—the limestone hills of to-day. These hills are a very characteristic feature of the country. From an incoming vessel they are plainly seen projecting like saw teeth all along the coast; from an eminence back in the country they appear to have no system or regularity whatever, but stick up anywhere sharp and rugged as though shaken out of a dice box onto a board. Further inland they are closer together with no plain between, though in other respects like those of the coast. It is as though they were eroded when the sea stood lower than it does to-day, perhaps very much lower; then the valleys were filled up during a period when the sea was slightly higher than at present, whence it has receded and left the island of to-day. They are covered with a characteristic jungle, rising conspicuously out of which is the "Llume" palm (*Aena attenuata*) whose graceful stem, only about half a foot thick at the base, attains a height of a hundred feet, tapering till it is only three or four inches thick at the top. It is nearly white and at a distance entirely invisable, so that the crown of leaves looks as though it were floating around in the air above the surrounding vegetation

Further inland the limestone hills give way to others of red clay The clay, like the limestone, is very deeply eroded In most places it is so continually washed down that the sides of the hills stand always at the critical angle and are ready to slide from under the feet of the explorer Indeed it would be impossible to climb them were it not for the numerous bushes everywhere standing ready to lay hold on Here abound ferns, Melastomaceae and other plants of humid regions Tree ferns are very common, the largest belong to one species of Cyathia Its beauty is simply beyond description Imagine, you who have never seen it, a trunk thirty feet tall surmounted by a crown of a dozen or fifteen great leaves made up of a score or two pinnae of the size and grace of ordinary ferns and you have the components—not the ensemble—of the tree fern.

This red clay region is the land of coffee Everywhere the novice thinks the hillside covered with jungle, which turns out to be only poorly kept coffee plantations The coffee region is coextensive with the range of several plants Two or three species of the pepper family, with large peltate or round leaves, are found only here, and with one or two exceptions the Melastomaceae occur only in this wet country. They are a very large group of plants common throughout the tropics, but represented in the northern states by the common Rhexia Its members may be known anywhere by their three-nerved leaves, many of which are beautifully patterned and marked so that even among other tropical plants they are conspicuous for their beauty

When we cross the summit we come upon a different sort of vegetation, cacti take the place of tree ferns, and instead of wet jungles we have dry scrub brush full of spiny and thorny shrubs with almost every sort of prickle one can think of One who has never encountered them can scarcely appreciate the abundance and effectiveness of tropical thorns These thickets of brush extend over most of the undisturbed portion of the south side Everywhere through them there are scattered cacti of several sorts; but near Guayanilla, a few miles west of Ponce, these become relatively much more numerous so as to form a veritable cactus desert Only here is the largest form present. It is a large Opuntia with a bare stem and long arms radiating in one or two whorls near the top. Besides it there are several species of Cereus and another small Opuntia similar to the common prickly pear, together with a species of the same group cultivated for its fleshy branches which are eaten All through this dry region agaves or century plants are very common There seem to be several species, but they are such terrors to botanists that it is hard to tell anything about them

From this brief sketch it will be seen what a diversified flora Porto Rico offers to the student There are opportunities for several ecological studies of surpassing interest, and on the systematic side the work has only been begun At present there are scant facilities for the student, but with the fuller occupation of the island by American government and customs, we may hope that some of our enterprising universities will establish there a school of tropical agriculture and botany, fields now white for the harvest but almost without workers

Washington, D C, October 30, 1901

SALAMANDERS TAKEN AT SUGAR GROVE.

MAX MORSE

On May 25, 1901, Prof Hine, while collecting in the hills at Sugar Grove, Fairfield County, O, found a salamander under a piece of pine log on the slope of a hill, about a hundred yards from water It was, for the time, put in a jar along with several individuals of Desmognathus fusca Raf, which were taken in, or within a few feet of the rivulets which flow down the valley Aside from this specimen taken on the hill-side, all the specimens were found not farther than a half dozen feet from the water When the collections were examined in the laboratory it was found that the single specimen just mentioned differed in many respects from the others' This led to investigation and it was found that it corresponded closely with the description of D. ochrophæa Cope. Thus, the posterior portion of the mandible was edentulous, no tubercle in canthus ocelli, belly paler than in any of D. fusca taken, length nearly three-fourths of an inch shorter than the others, a light bar from eye to corner of mouth, tongue free behind, parasphenoid teeth separated behind The specimen was kindly examined by Dr J. Lindahl, of the Cincinnati Society of Nat Hist, who is acquainted with the form. He agreed that it corresponded with the description of Cope. Whether the characters as given above are sufficient to place the specimen under ochrophæa is a matter hard to decide Cope gives the range of ochrophæa as "in the Alleghenies and their outlying spurs" Dr Lindahl has a specimen from Logansport, Ind, taken November 10, 1900

FISHES TAKEN NEAR SALEM, OHIO.

E B. WILLIAMSON

The present short list is published, not because of any records of special interest, but in order that a record may be made of the fish known certainly from the headwaters of Beaver Creek In the case of fish the most logical and significant way to indicate distribution is certainly by streams, and a very small contribution to the ichthyology of the above named stream is here presented

About three-fifths of Columbiana County is drained by Beaver Creek, one-fifth by the Mahoning River and streams leaving the county to the west, while the remainder enters the Big Yellow and Little Yellow Creeks Beaver Creek is practically confined to Columbiana County, though it empties into the Ohio River in Pennsylvania at Smith's Ferry, just above the state line The relation of Beaver Creek to the Mahoning River is interesting, the two being in general, arcs of concentric circles with the Mahoning outside A person going directly west from Salem crosses Middle Fork of Beaver Creek first, then the Mahoning, and the same is true if he goes directly north or directly east South-west of Salem the small streams emptying into the Mahoning have not been seined From one of these Herman McCane has taken a specimen of Ichthyomyzon concolor which is preserved in the Salem High School collection with the other species here recorded All the other streams in close proximity to Salem are part of the system of the Middle Fork of Beaver Creek, with the exception of Cold Run, which flows almost directly south into the West Fork of Beaver Creek, the stream thus formed soon being augmented by the waters of the North Fork

Seining has been done only near Salem in small tributaries and where Middle Fork has an average width of not more than ten or twelve feet Mr. Albert Hayes, Mr J S Johnson and Mr F W Webster have helped me draw the seine Mr. Webster has also given me many valuable suggestions as to suitable localities

1 **Ameiurus melas (Raf)** Rare, only in main stream
2 **Catostomus commersonii (Lac)** Common, main stream and tributaries
3 **Catostomus nigricans Le S** Taken only in a small tributary
4 **Moxostoma aureolum (Le S)** In a small tributary
5 **Cyprinus carpio L** Only in main stream
6 **Campostoma anomalum (Raf).** Everywhere
7 **Chrosomus erythrogaster Raf.** In two small tributaries
8. **Pimephales promelas Raf** In main stream only
9 **Pimephales notatus (Raf)** Everywhere
10 **Semotilus atromaculatus (Mitch)** Everywhere.

11 Leuciscus elongatus (Kirt.). In one tributary and in Cold Run. The iridescent coppery red of the sides anteriorly in the living fish, taken in October, turned scarlet in alcohol.
12 Abramis chrysoleucas (Mitch.) Taken only in main stream.
13. Notropis cayuga Meek. A single specimen taken in Cold Run.
14 Notropis cornutus (Mitch.) Everywhere.
15 Notropis rubrifrons (Cope) Taken only in main stream.
16 Notropis umbratilis lythrurus (Jordan) Taken only in main stream.
17 Ericymba buccata (Cope) Everywhere.
18. Rhinichthys atronasus (Mitch.). In the smallest tributaries.
19 Hybopsis amblops (Raf.) In Cold Run.
20 Hybopsis kentuckiensis (Raf.) Taken only in Cold Run, a single specimen.
21. Umbra lima (Kirt.) Taken only in the main stream.
22 Eucalia inconstans (Kirt.) Taken only in the main stream.
23 Ambloplites rupestris (Raf.). In main stream and one tributary.
24 Apomotis cyanellus (Raf.) Taken in Cold Run.
25 Lepomis megalotis (Raf.) Taken only in the main stream.
26. Eupomotis gibbosus (Lin.) One specimen taken in a tributary, determined by Dr. Evermann. Numbers 25 and 26 probably represent one species.
27 Micropterus dolomieu Lac. Taken only in the main stream.
28 Boleosoma nigrum (Raf.) Everywhere.
29 Etheostoma flabellare Raf. In the main stream and Cold Run.
30 Cottus ictalops (Raf.) Taken only in Cold Run.

MR A J PIETERS, Assistant Botanist in the U S Dept of Agriculture, has written an interesting and useful article[*] on the plants of western Lake Erie. This report should be read by all who are interested in the hydrophytes of Ohio, or in the flora and fauna of Lake Erie. In addition to some introductory remarks, the paper treats of the plants in Put-in-Bay, in Squaw Harbor, near Gibraltar Island, in Hatchery Bay and in the open lake, and the plants of East Harbor. The swamp vegetation is also discussed, including the plants in the Portage River swamps and in the swamps about Sandusky Bay. The ecological conditions and the ecological adaptations of the flora are treated quite fully, and at the end are given alphabetical lists of the plants studied, including angiosperms, stoneworts and desmids.

JOHN H. SCHAFFNER.

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[*] A J PIETERS "The Plants of Western Lake Erie, with Observations on their Distribution" Bull U S Fish Commission, 1901, pp 57 79 Pls 11-20

COLLECTING TABANIDÆ.

JAMES S HINE.

The habits of flies belonging to the family Tabanidæ, commonly called horse-flies or gad-flies, furnish much material for study and observation I take this opportunity to record some of the notes which I have taken in the last few years while endeavoring to collect and study the local species of the family Although the eggs, larvæ and pupæ of many species have been studied, what I have to say in this paper pertains wholly to the adults Members of the family are usually taken by every entomologist who does general collecting, but as a usual thing males are seldom taken, in fact this sex is so poorly represented in collections that no key has been published for identifying the males of our American species The student must use the key to the females as far as possible and guess at the rest In very many cases the male is not even described, so that sometimes, when the sexes are unlike, they can be associated only by observations in the field By careful collecting and observation we have procured practically all of our local species in both sexes, and the derived benefit, satisfaction and enjoyment have paid us fully for our time and pains

In the first place the mouthparts of the two sexes are different—the male lacks the mandibles which are present in the female This makes it necessary for them to procure their food from different sources, the male obtains his from flowers, while the female lives by puncturing the skin and sucking the blood of warm-blooded vertebrates Thus it is evident that during the time spent in procuring food the sexes cannot remain together From an economic standpoint the female most concerns the student and she is often taken for study without an attempt being made to procure the male

At this point I can say collect females around horses, cattle and other animals, and males on flowers, but this is not enough, for knowing the general habits of insects we are certain that there is a common ground where the two sexes may be found together One finds this common ground in the vicinity of water, where their transformations take place and where their eggs are laid, also in various other places, which we shall take occasion to discuss as we proceed

The females of all our local species of Chrysops with Tabanus pumilus and nivosus come buzzing around the collector in numbers, and at such times may be taken easily with a net. Other species of Tabanus come near enough that the sound of their wings is recognizable, but are so active that it is almost impossible to procure them.

During the time the female is ovipositing the male is often sitting near by on the foliage. At Georgesville, Ohio, June 4th, I observed C mœchus ovipositing on foliage overhanging a mill-race, soon after specimens of the male sex were observed resting on the upper leaves of the same plant on which females were ovipositing In a few minutes collecting, a dozen or more specimens of each of the sexes were procured. The only males of C indus I have ever taken were procured at Columbus, on the border of a small pond, where the females were ovipositing.

The sexes of many species of Tabanus often alight on the bare ground of paths or roads that run through or along woods At Cincinnati, June 10th, in company with Mr Dury, we procured large numbers of the sexes of different species resting on some furrows that were plowed around a woods to prevent the spread of fire We also took the same species resting in paths and roads that ran through the woods Some of these same species were also taken from low-growing foliage in sunny places among the trees At Medina, Ohio, males and females of T vivax and trimaculatus were taken while resting in a road that ran through a dense woods

One of the best places I have ever found to get the sexes of Chrysops and Tabanus is in the tall grass that skirts the marshes of Sandusky Bay This grass is the Phragmites of botanists and grows to a great heighth by July 1st On July 6th, at Black Channel, when the wind was high I went into a patch of this grass that was so dense that I could not use a net to advantage. Here I saw an abundance of flies and found that by approaching them very slowly I could readily pick the specimens off with my fingers The male and female of T stygius, niveosus, C æstuans and flavidus and the male of T affinis and bicolor were taken in this way. I found that this same species of grass afforded excellent collecting wherever found, but most material was procured when the wind was high On the same date and near the same place the male of C flavidus was taken from the flowers of the common spatter-dock, and this and æstuans were procured by sweeping in the adjacent low-growing herbage. R C Osburn informs me that he has had excellent success in collecting Tabanids from tall grass near water in his experience

Tabanus sulcifrons Macq is an abundant species in northern Ohio during the latter part of July and all of August. So common that by actual count twenty-eight specimens were taken from a cow in ten minutes, while a few that alighted on the animal during that time were not procured. August 1st of the present year I was at Hinckley, Medina County, and spent the day taking observations on this species In the morning about nine o'clock I went to the border of a woods where I had often observed the species before Here males and females were found in abundance crawling over the trunks and foliage of trees, on the fence along the woods and flying about generally. One pair was observed in copulation on the fence, and I am of the opinion that the presence of so many flies in the locality at the time is explained on the ground that it was the general mating place of the sexes. On several occasions I have made observations which lead me to believe that the sexes of various species of the family copulate among foliage often high up in the trees. As Tabanids are not easily procured with a net from the surface of a rough rail, I tried the experiment of picking the specimens off with my fingers and found that it was surprisingly successful, if the movement toward them was made very slowly until just ready to touch them when the fingers were gripped quickly. Near a watering trough where a herd of cattle drank daily I found males in numbers resting on the ground where the turf had been tramped off. Along Rocky River I observed both sexes fly down to the water and dip several times in succession and then away to alight on a stone on the bank or disappear from sight altogether.

On July 29th I rode from Sandusky to Cleveland by boat. Although we were from two to five miles off shore all the time, males and females of T. sulcifrons often came on board and alighted on the canvas and rigging of the boat. From this it is evident that this species at least may fly for some distance over water.

We have taken Goniops chrysocoma on several occasions. It has a habit which is of value to the collector. At Hinckley, Medina County, I took several females and observed that they have the habit of stationing themselves on the upper side of a leaf where by vibrating their wings rapidly and striking the upper surface of the leaf at each downward stroke, make a rattling noise which can be heard plainly several feet away. At Vinton last spring Mr. Morse and myself identified the characteristic sound of the species and were guided by it to procure specimens.

I have taken the male of Pangonia rasa on blossoms of sumac at Medina, Ohio, in August.

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OBSERVATIONS ON INSECTS.

JAMES S. HINE.

AGROMYZA SETOSA Loew.—The larvæ of several species of the genus Agromyza are known to mine the leaves and stems of various plants. Cabbage, potatoes, corn, clover, strawberries, verbenas, chrysanthemums and sunflowers are among the cultivated plants from which various species of the genus have been reared; while plantain, round-leaved mallow, golden-rod, aster, cocklebur, rag-weed and wild-rice are given as their food-plants. In some cases a single species of fly has been reared from a half dozen or more different plants. Agromyza setosa Loew, as determined by Coquillett, was reared in numbers from leaves of wild-rice, Zizania aquatica, at Sandusky during August of each of the years 1900 and 1901. Professor Osborn studied the species and its work in 1900, while my observations were made a year later. Although I include the notes taken by both of us, many points are needed before a detailed account of the habits and life history of the species can be given.

The eggs are conspicuous on account of their abundance and white color, and are deposited chiefly on the upper surface of the leaves of the food plant

The larvæ upon hatching bore into the leaf and feed beneath its upper covering. When full grown they measure about 6 mm in length, are white, or greenish on account of chlorophyl taken in with their food, and are furnished with strongly chitenous mouth parts The mines which they make in the leaves are irregular in width and extend for varying lengths on one side or the other of the mid-rib These variations in extent are usually explainable from the fact that a variable number of lavæ occupy the different mines The work of the larvæ is apparent from the first on the upper side of the leaf, and may be seen beneath after a few days because of the fact that the parts beneath the mine sooner or later turn yellow.

The pupa is to be found either in the mine or clinging to the surface of the leaf. It is brown in color, with two prominences anteriorly where the attachment with the leaf is effected, and is contained within the last larval skin so that the legs and wing-pads are at no time visible from the outside.

BIBIO ALBIPENNIS Say—Larvæ observed in colonies under fallen logs, and boards which were lying on the ground. Specimens taken April 4th pupated May 5th and the adults appeared May 13th. The adults were unable to fly for several hours after they emerged on account of their wings remaining soft I observed the first males flying out of doors on the 23d of May

CHRYSOPILA ORNATA Say—Larva about an inch and a half in length, white in color, cylindrical, with an enlargement at the posterior end bearing a number of fleshy elongations which are about the length of their basal breadth Found under rotten wood May 1st Pupa brown, last segment armed with six spinose teeth, the two on the ventral side arising from the same base, the remaining abdominal segments furnished with a circlet of spines near the posterior third. The adult emerged the 18th of June.

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THE SELF-PRUNING OF WOODY PLANTS.

JOHN H. SCHAFFNER.

In a former article[*] by Mr Frederick J Tyler and the writer, the subject of the self-pruning of woody plants was discussed in a general way, and a number of notes were presented, giving the facts observed up to the time of publication. During the past year the writer has made further observations, which have confirmed the views previously expressed and also added some phenomena not mentioned in the former paper. The work was carried on during the summer in northern Kansas, and continued during the fall in central Ohio.

The past summer was notable for the severe and long-continued drouth, which extended over a large portion of the interior. This cause may have had some effect on the cottonwood, Populus deltoides Marsh., which was self-pruning very abundantly before the 15th of July. Many of the branches cut off still retained perfectly green leaves, while on some the leaves were withered or yellow, and others were entirely defoliated before they fell to the ground. The tree shown in the picture (Fig. 1) was standing alone on the prairie. It was photographed on July 17, 1901, and at this time had already cast a large number of branches.

It was discovered that from the middle of July up to the time of complete defoliation numerous branches with fresh, green leaves were from time to time falling to the ground. Other plants were observed shedding twigs with green leaves, among which may be mentioned Populus grandidentata Mx., Salix nigra Marsh., Quercus alba L. and Ulmus americana L. These cases seem to show that the formation of the cleavage plane is often quite rapid, so that the leaves do not have time to wither before the branches are detached.

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[*] Schaffner, John H., and Tyler, Fred J. Notes on the Self Pruning of Trees. Ohio Nat., 1: 29-32, 1901.

A considerable number of self-pruning plants were studied which were not included in the former list. The following form basal joints with cleavage planes: Quercus platanoids (Lam.) Sudw., Quercus Alexanderi Britt., Quercus prinus L., Rhamnus lanceolata Ph., and Ulmus racemosa Thom. The latter develops cleavage planes in the nodes caused by annual growth, the same as was described for Ulmus americana L.

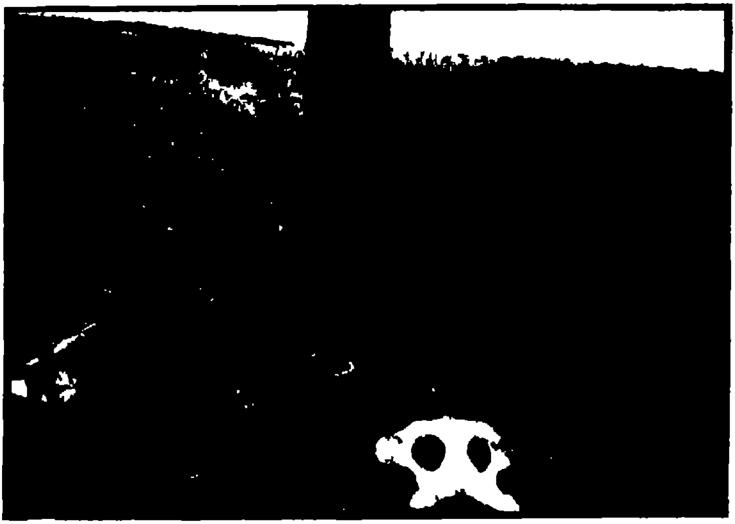


Fig. 1

Two trees may be quite closely related and still act entirely different when it comes to the matter of self-pruning. For example, Ulmus americana L. has developed the self-pruning habit to a remarkable degree, while the process seems to be entirely absent in Ulmus fulva Mx. The same is true in the oaks. Quercus alba L. and Quercus acuminata (Mx.) Sarg. self-prune abundantly, while in our common red oaks no such process was discovered, although diligent search was made. The following oaks failed to show any evidence of self-pruning: Quercus rubra L., Q. palustris Du Roi, Q. coccinea Wang., and Q. velutina Lam. It may be that the whole red oak group is devoid of this habit.

In some of our willows very numerous branches are developed at the beginning of each growing season. It was found that in many cases a large part of these branches drop to the ground long before the growing season is ended. A true basal joint is formed and the twigs are cut off by the development of a cleavage plane. This is therefore a process distinct from the development of brittle zones in the ripe branches, which may be one or more years of age. This process of shedding twigs of the season is well developed in Salix interior Rowlee, our common long-leaved willow. On July 11th numerous branches of the season were being cut off in this plant, some with leaves and some with the leaves shed. The writer saw any number of such branches on the ground under a patch of long-leaved willows, and also many which would fall at the slightest touch. In Salix fragilis L. this process is also prominent, and small, green branches were shed abundantly before August 13th. The same thing was observed in Salix amygdaloides Adrs., although it seemed to be much less developed than in the two previously mentioned species.

In some plants the branches of the season which bear the inflorescence fall off after the fruit has matured, and in this way the individual is kept in a properly pruned condition. This is the case in Prunus cerasus L., the common sour cherry, where the short branches which bear the umbel-like clusters of flowers drop off later in the season. The same appears more prominently in Prunus virginiana L., in which the flowers are in racemes, terminating short, leafy branches of the season. These drop off after the fruit is ripe, and thus the shrub is kept well pruned, since these short, flower-bearing branches are produced very abundantly.

Mr. Tyler called my attention to the hackberry, Celtis occidentalis Mx., in which the slender annual fruiting branches also drop to the ground during the fall and winter. These branches dry off at the outer ends while the fruit ripens, and are then very abundantly detached at the base, where a brittle layer appears to be developed. It is interesting to note that the base containing the brittle layer remains green for a short distance up the branch. The writer has gathered large quantities of such branches under fruiting hackberry trees. Many of the branches fall with berries still attached, although usually the berries have all been shed before the branches break off. Occasionally some of the ordinary green branches are detached, the base becoming quite brittle. So far as observed, however, no special process of self-pruning appears to be present except that of the fruiting branches.

Several varieties of the cultivated grape, Vitis labrusca L., were observed to prune themselves to a limited extent by the formation of transverse joints, corresponding to the leaf nodes, in the same way as was described for Ampelopsis cordata Mx. This is also true for the common riverside grape, Vitis vulpina L., which prunes itself quite extensively. It is probable that all of our wild grapes possess the process of self-pruning, although no further observations have been made on this point by the writer.

In this place it may be well to call attention again to the formation of joints and cleavage planes in certain geophilous, herbaceous plants. These are especially remarkable in Psoralea floribunda Nutt. and Psoralea argophylla Pursh., and similar joints are no doubt formed in many other such plants.

As is well known, the American mistletoe, Phoradendron flavescens (Ph.) Nutt., produces numerous joints, which from herbarium specimens appear to develop cleavage planes and thus prune off branches. The same appears to be true also to a more striking extent in the European Viscum album L. The writer has had no opportunity to study these plants in the field, but it is probable that the whole family of Loranthaceae would afford an interesting study along this line.

It is curious that, in so recent a work as Bailey's Cyclopedia of American Horticulture, no mention is made of the remarkable process of self-pruning in the article on artificial pruning. The subject is practically dismissed by the statements that "nature prunes," and that "dying and dead branches in any neglected tree-top are illustrations of this fact." But no reference is made to the formation of cleavage joints and the cutting off of green branches, nor the perfect manner in which the scars heal over in many trees. The writer believes that horticulturists should study these processes with great care, since these natural phenomena will probably indicate fundamental principles which will be well worth considering when an attempt is made to approach the subject of artificial pruning in an intelligent manner.

OHIO TUMBLE WEEDS.—The following plants should be added to the list of Ohio tumble weeds, as given in the OHIO NATURALIST I: 129.

Baptisia australis (L.) R. Br., perennial, frequently acts as a tumble weed, although it does not seem to develop a special cleavage joint in the stem.

Solanum rostratum Dunal., annual, makes a good tumble weed.

Sisymbrium altissimum L., Tumbling Mustard, has been reported from eastern Ohio by L. D. Stair.—J. H. S.

MALLOPHAGAN RECORDS AND DESCRIPTIONS.

Herbert Osborn

I THREE NEW PARASITES OF THE TURKEY BUZZARD

Menopon alternatum n sp. (Plate 11, Fig 1)

Broad, distinctly banded on the thorax and abdomen with fuscous Female—Length, 1 97 to 2 09 mm , head, length 32, width 288, thorax, length 448, width 40, abdomen, length 1 34, width 1 312, hind femur, 28, 29, tibia, 25, antenna, 112

Head very broadly cordate, anterior border semi-circular, posterior border concave, a few bristles along anterior margin and several short strong spines, and about three or four bristles at posterior angles Antennal pits deep, antennæ not or scarcely projecting beyond margin Prothorax with prominent lateral angles and obtuse postero-lateral angles, posterior border slightly curved, bearing about eight bristles Lateral angles of the mesothorax sharp, a row of bristles across mesal portion same as metathorax, each having also diffuse fuscous band Abdomen broadly ovate, lateral angles with several bristles of moderate length , a broad transverse band on segments one to seven inclusive, the eighth having a rather broad diffuse fuscous area , the bands are about equal in width to the interspaces, each segment has marginal series of bristles and about two irregular series anterior to the marginal, terminal segment with ciliate margin

Male Similar in form to the female, but abdomen apparently a little broader in proportion The genital apparatus consists of a Y shaped penis, behind which is a broad heavy U-shaped structure, bordered at sides with slender lateral appendages, with almost thread like processes anteriorly and slightly curved processes posteriorly

Length, 1 82 to 1 84 mm Head, length 272, width 416, thorax, length 43, width 27, abdomen, 1 04, 1 15, hind femur, 27, 24, hind tibia, 24, antenna, 112, 09

This species approaches the Menopon zonatum Piag occurring on the condor, Sarcorhamphus gryphus, but it is to be distinguished from it by the wider head, the very uniform bands, the smaller size and by the genital apparatus It was taken in considerable numbers from a turkey buzzard at Ames, Iowa, April 21, 1890, and I have also received specimens from Prof. Lawrence Bruner, which were collected from the same species of bird at Lincoln, Nebraska

Colpocephalum kelloggi n sp (Plate 11, Fig 2)

Slender, light yellow, with conspicuous black and fuscous or dark fuscous markings on head and borders of femora and tibiæ, and lateral margins of segments one to seven of abdomen Length, female, 1 84 mm , male, 1 42 mm

Head of usual form, lateral sinus deep, ocular and occipital spots very dark, partly black and connected by red brown bands Antennæ passin margin of head by full length of distal joint Palpi conspicuous, outer joint passing anterior border of head, mandibles sharp, anterior border of head obtusely rounded, postero-lateral lobes broad, a few short spines and two or three long bristles. Prothorax lenticular, lateral angles acute, bearing one or two bristles, hind margin evenly convex, with about five or six bristles near middle, meso-metathorax widening abruptly and passing insensibly into abdomen, and like segments of abdomen, with marginal bristles, Abdomen widening to third segment, elongate oval attenuated apically, segments 1 to 7, with lateral fuscous patches confined closely to border, and including at extreme border a black spot or marginal border Eighth segment with a comb of curved hairs at lateral margin in female, and inner row of about ten parallel to border on ventral side Legs nearly uniform, becoming a little longer posteriorly, outer border black, with row of short spines

Males with marginal spots wider and a little more diffuse

Taken from the turkey buzzard, Cathartes aura, at Ames, Iowa, April 21, 1890, and also received from Prof Lawrence Bruner from same host, Lincoln, Nebraska Closely related to the Colpocephalum osborni Kellogg, and agrees with that species in the curved brush of hairs on eighth segment in female Differs from it in the fuscous bands being confined more narrowly to the margin, the more slender body, more attenuate terminal segments and the larger size

Lipeurus marginalis n sp

Elongate, the margins of metathorax and abdominal segments with slender dark lines Length, female, 2 5 mm

Head long, rounded in front, slightly narrowing apically, contracted toward occiput, posterior margin slightly emarginate There are six inflated pockets in border of head anterior to the antennæ, three on each side Antennæ tapering to the tips, the joints decreasing in length as well as in size to fourth, fifth about as long as third. Metathorax with narrow black marginal lines, abdominal segments one to seven with narrow black border, the disk of abdominal segments with long bristles and one or two shorter bristles at lateral angles Legs with narrow black borders on outer margin of femur and tibia

This species belongs to Piaget's group of quadriguttata, and approaches assessor from the condor, but is smaller and the markings confined to the narrow marginal lines

Two specimens, females, taken from the turkey buzzard, Cathartes aura, at Ames, Iowa, April 21, 1890.

DESCRIPTION OF PLATE Fig 1 *Menopon alternatum* n sp *a* female, *b*, male genitalia *c*, ventral view, tip of abdomen female The figure is from a specimen which shows rather too much contraction at base of abdomen

Fig 2 *Colpocephalum kelloggi* n sp, *a*, female dorsal view, *b*, male tip of abdomen *c*, female ventral view, tip of abdomen

Fig 3 *Trichodectes nasualis* n sp Female

Fig 4 *Trichodectes thoracicus* n sp *a*, female, *b*, tip of abdomen of male

Figures drawn by Max W Morse

OHIO NATURALIST *Plate II.*

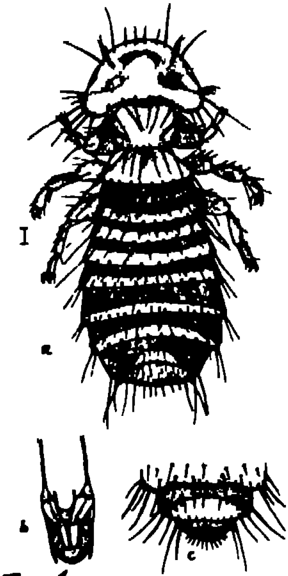


Fig 1

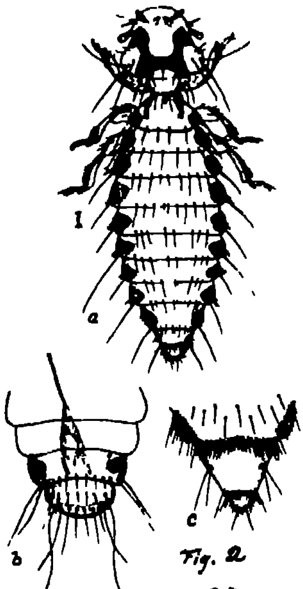


Fig. 2

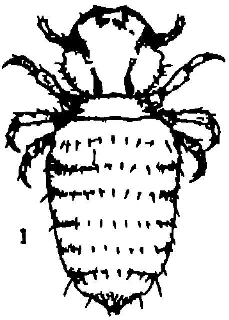


Fig 3

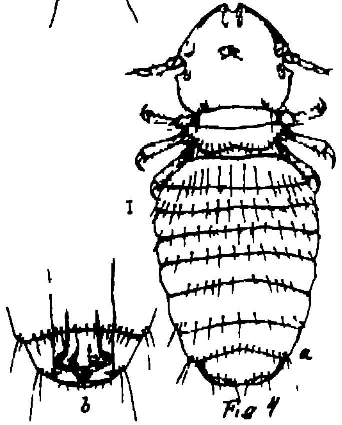


Fig 4

OSBORN ON MALLOPHAGA.

II. TRICHODECTES OF THE CENTRAL AMERICAN COATI AND THE RING-TAIL FOX.

Trichodectes nasuatis n. sp. (Plate 11, Fig. 3.)

Broad, light yellowish, abdomen ovate. Length, female, 1.60 mm.

Head slightly wider than long, semi-circular in front with shallow emargination at apex and a shallow furrow running from apex to mandibles. Antennal pits rather deep, antennal lobes extending back in obtuse rounded angle, and behind the antennal pit is a rather prominent lobe, behind which the border curves toward the occiput, the postero-lateral angle being very obtuse. Antennæ rather slender, joints of about equal length, second shorter than first and third. Thorax short, legs nearly uniform in size, anterior tarsal claws short, middle and posterior longer and more slender. Abdomen ovate, broadest about second segment, tapering uniformly to sixth segment. Scattering bristles on posterior border of each segment inconspicuous, longer on ventral side than dorsal, lateral appendages of seventh segment not conspicuously separate from the border.

This species differs from crassus in having the postero-lateral lobes rounded and head narrower. As compared with T. pallidus described from Nasua rufa of South America the head is less emarginate in front, not so wide as compared with length, and not near so broad or angular for posterior angle, and also varies in size.

Described from three mature females and one immature individual sent me by Mr. George K. Cherrie from Costa Rica, taken from the coati, Nasua narica.

Trichodectes thoracicus n. sp. (Plate 11, Fig. 4.)

Short and broad. Head rounded in front, with deep semi-circular emargination and with very strong chitinous borders to the mandibular furrow. A strong projection on anterior border of antennal pit extending over base of antenna. Thorax short, prothorax narrow, short, metathorax with a strong process or inflation on antero lateral border, the posterior margin of which bears a row of spines, which is continued across hinder border of the segment. The abdomen is ovate, widest at the second and third segments, strong bristles on one to six, no transverse dusky bands, lateral appendages on seventh segment, conspicuous and strongly curved.

Male, antennæ with large swollen basal joint and the head is somewhat more pointed in outline. The genitalia are strongly developed, the lateral pieces wide apart, connected by median bow with a sharp process at tip, and the posterior end of penis with strong bidentate process.

This species resembles retusus in size and shape and depth of the frontal emargination, but has no transverse bands, and differs particularly in the large lateral processes of the thorax and in details of genitalia. On Bassaris astuta, Lake county, Cal., from Prof. W. G. Johnson.

MINOR PLANT NOTES, No. 4.

W A KELLERMAN.

BRACTED RACEMES OF LAPPULA VIRGINIANA.—In his description of the Virginia Stickseed, Lappula virginiana (L) Green (given in Gray's Manual as Echinospermum virginianum Lehm), Britton says (Ill Flora, 3 55) of the racemes that they are "*bracted at the base.*" Gray (Man , 362) includes this species in a section which has the racemes "*leafy-bracteate at base*" Mr. F H Burglehaus calls our attention to the fact that the plants growing about Toledo have racemes bracteate almost to the apex. Specimens in the State Herbarium from the counties of Clermont, Fairfield, Franklin, Huron and Union also exhibit bracts, not only at the base, but these are continued, though much reduced upwardly, well toward the tip of the raceme Specimens in the General Herbarium from Oklahoma and Tennessee are similar in this respect A slight emendation of the printed description seems desirable A sketch, natural size, is here appended (Fig 1) to show the bracted raceme, taken from one of the Ohio specimens.

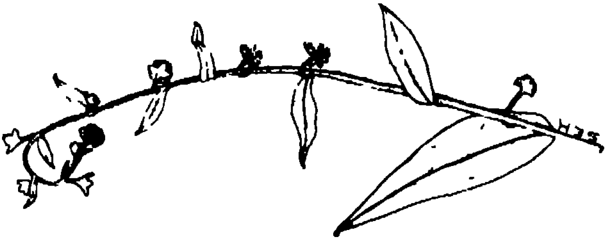
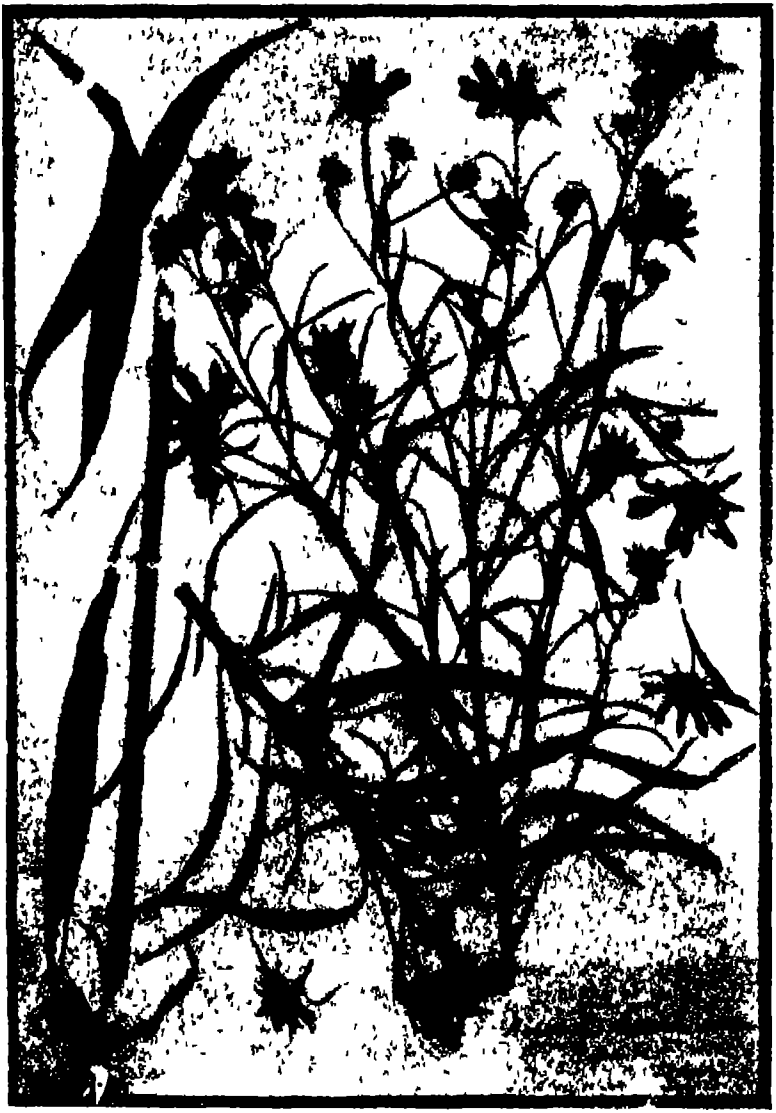


Fig 1. A RACEME OF LAPPULA VIRGINIANA, SHOWING BRACTS

A NEW SUNFLOWER —A few years ago roots of the native species of Helianthus were brought from the vicinity of Columbus and planted on the college campus south of the Botanical building, Ohio State University In 1897 a form was noticed that differed materially from the enumerated species of the state Later it was observed more carefully, and finally specimens were submitted to Britton of the New York Botanical Garden

The accompanying plate will give some idea of this elegant sunflower It is not coarse and weedy in habit as so many of the other species, though rather tall It is a good bloomer and would doubtless be desirable for ornamental planting Roots will be furnished gratis to botanic gardens and to all who may wish to grow this form for observation or for ornamental purposes Herbarium specimens are likewise on hand for those wishing the same.



HELIANTHUS KELLERMANI BRITT

Dr. Britton has described this sunflower in his "Manual of the Flora of the Northern States and Canada," published by Henry Holt & Co., New York, 1901, from which the following is reproduced.

"Helianthus Kellermani Britton, n. sp. Kellerman's Sunflower. Stem 2-3 m high, very smooth, much branched above, the branches slender. Leaves narrowly elongated-lanceolate to linear-lanceolate, drooping, rather thin, distantly serrate with very small teeth, long-acuminate at the apex, attenuate at the base into short petioles or the upper sessile, scabrate and sparingly pubescent on both surfaces, pinnately veined, the lower about 2 dm. long and 1.5 cm. wide; branches of the inflorescence pubescent; bracts of the involucre linear-lanceolate about 1.5 cm. long and 1.5 mm. wide at the base, ciliate, long-acuminate; rays golden-yellow, ¾ cm. long; chaff of the receptacle linear. Columbus, Ohio. W. A. Kellerman, Sept. 5, 1898."

SCUTELLARIA PARVULA AMBIGUA (Nutt.) Fernald.—In Rhodora, **3**: 198–201, July, 1901, Fernald gives an interesting account of "Scutellaria parvula and S. ambigua." He says that Scutellaria parvula was published by Michaux in 1803, as follows: "S. pusilla, dense pubescens, foliis ovalibus, integris, omnibus conformibus, floribus axillaribus. Obs.—Affinis S. minori. Folia sessilia, parvula, ima interdum subdentata. Hab. in regione Illinoensi et Canada." In 1825 Sir William Hooker noted another character, namely, "plant everywhere covered with short glandular pubescence." The other form, the smoothish plant, was first described by Nuttall in 1818 as Scutellaria ambigua, having a "stem four to six inches high, smooth, mostly purple." This was, however, reduced to S. parvula, and neglected generally, though Gray described it as "var. mollis." Britton raised it to specific rank and called it S. campestris. Mr. Fernald furnished diagnoses of the two forms, S. parvula Mx. as a species and ambigua as a variety of the former. The distribution in Ohio as shown by specimens in the State Herbarium is as follows: Scutellaria parvula Mx., Ottawa, Clarke, Madison and Hamilton counties; Scutellaria parvula ambigua (Nutt.) Fernald, Franklin, Greene, Montgomery and Gallia counties.

The following donations have been received for the zoological museum recently:

A fine specimen of the Florida tarantula, from Southern Florida, by William F. Sauer, of Columbus.

A specimen of the Gila monster, Heloderma suspectum, Cope, from J. W. Estill, of Oracle, Arizona.

A specimen of Cassowary from Australia, from Sells' Brothers, circus managers, of this city.

WARBLERS NESTING NEAR CINCINNATI.

CHARLES DURY

The following members of the family Mniotiltidæ breed near this city.

Mniotilta varia (Linn.), black and white creeper. I have not found the nest of this species, but have seen the young just out of the nest fluttering through the bushes—July.

Helmitherus vermivorus (Gmel.), worm-eating warbler. A specimen taken in June, 1877, contained an egg ready to be laid. Nest not found, although diligently searched for.

Helminthophila pinus (Linn.), blue-winged yellow warbler. Several nests taken in woods with much underbrush. One containing five fresh eggs was taken May 31, 1901. Nest was on the ground and composed outside of leaves, lined inside with grapevine fibres.

Dendroica æstiva (Gmel.), summer yellow bird. Many nests observed—May–June.

Dendroica cærulea (Wils.), Cærulean warbler. June 2, 1895, I found a young bird of this species that had fallen from the nest, but was not able to fly. Nest was in a high tree overhead. Old bird seen.

Dendroica dominica albilora Ridgw., white browed warbler. Have seen nests of this species, but they were so high up in sycamore trees (thirty to forty feet) that I was unable to obtain them. Birds are summer residents along streams, where they mostly frequent sycamore trees.

Seiurus aurocapillus (Linn), oven bird. Nests abundantly. Several taken in May and June.

Geothlypis formosa (Wils.), Kentucky warbler. Nests abundantly in wooded thickets. Have seen this species and H. pinus nesting in same thicket, which may explain H. cincinnatiensis. A nest taken June 2, 1895, contained three young birds and two eggs. This nest was placed in the forks of a bush near the ground, composed of leaves and lined with vine fibres. Another nest, June 28, 1901, contained four warbler's eggs and one of the cowbird.

Geothlypis trichas (Linn.), Maryland yellow throat. Nests frequently on the ground, among thick bushes. I have one nest with four eggs, dated May 1, 1878; several sets of later dates.

Icteria virens (Linn.), yellow-breasted chat. Nests in blackberry patches. Common. May–June.

These are all the warblers that I have observed breeding in this locality in about thirty years.

VARIATIONS IN THE WATER-SNAKE.

MAX MORSE

The following is the result of a study of the variations in the members of a litter of 33 young of the water-snake—*Natrix fasciata fasciata* (L.). The mother was captured at the Lake Shore Railroad bridge No. 13, Sandusky, Ohio, in August, 1901. The head of the mother was so mutilated on being killed that it was thrown away, and hence no comparative study of parent and offspring could be made. The young were very nearly ready to hatch and probably would have been born in a few days. With the exception of some of the gastrosteges, all external characters were as in the adult condition.

Owing to the want of time, only the external characters are considered in this paper. All measurements were made on the fresh specimens, *i. e.*, before the snakes were placed in formalin. Care was taken not to stretch the specimens more than was necessary to straighten them. The counting of scales, etc., was done under a lens and each count was verified twice.

The results of the study are given in the table on page 186. The following have been considered:

1. The variation in length from snout to tip of tail.
2. The variation in length from snout to the tip of the anal plate.
3. The variation in length from anal plate to the tip of the tail.
4. The variation in the number of gastrosteges, *i. e.*, the ventral plates.
5. The variation in the number of gastrosteges from their beginning in the gular region to the umbilicus.
6. The variation in the number of postoculars.

The maximum and minimum number, the difference between them, the mode and the mean are given in each case. Obviously, as the variates in columns 4, 5 and 6 are integral, the mean in these cases would sometimes be only approximate, *i. e.*, fractional. Under these conditions the probable error of the mean was not calculated, but only approximated, by adding an integer to the mean in case the fraction was greater than one-half.[*]

Comparing columns 2 and 3, it will be seen that there is greater variation in the body region than in the tail. This is contrary to what may have been expected, as in certain organs, such as the vertebrae, greater variation occurs in the tail than in the body.

In many cases the gastrosteges were found to be bifid, as in the normal anal-plate. The number of these that were found, together with their distribution, are given in column 7, where the numbers represent the number of the gastrostege, counting

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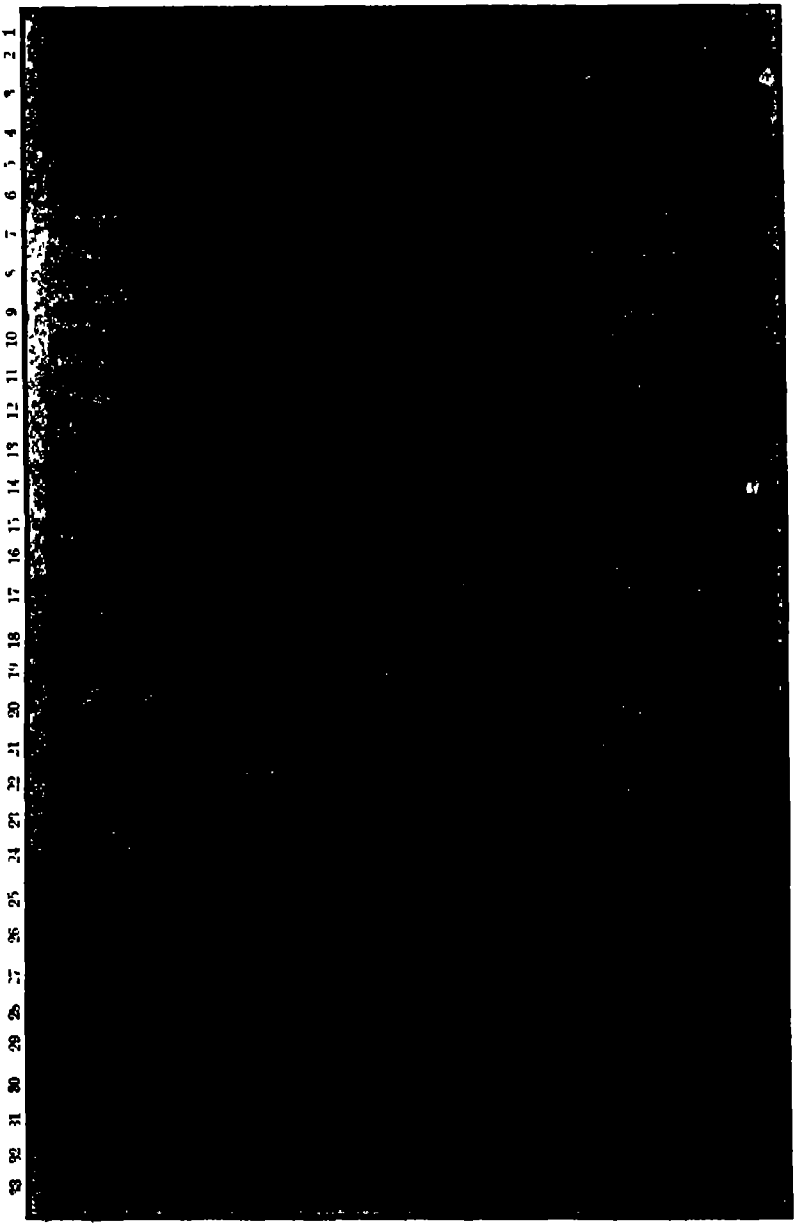
[*] Davenport, C. B., "Statistical Methods." John Wiley & Sons, N. Y., 1899.

OHIO NATURALIST. *Plate 13*



from the neck. The pre-anal scale was found to be bifid in several of the snakes. Since the gastrosteges represent modified scales—scales such as occur on the dorsal and lateral surfaces of the body—these bifid scales may represent a primitive condition, where the ventral scales were similar to the dorsal scales. This bifidity of gastrosteges is not at all common in the adults of this species Hence it seems probable that during succeeding moults the normal gastrostege is finally obtained A fact that points to this conclusion, indirectly however, is that on examining the labials, the fourth lower labial in specimen number 4 was found normal, but the epidermis, which had been loosened by the formalin, was seen to have a bifid labial corresponding to, and lying immediately above, the fourth labial This shows that in this case at least the labial was changed from a bifid to a single plate

The point of exit of the umbilical cord (*i e* , the yolk-sac and the allantois), the so-called dermal umbilicus, being an old structure, would be definite in position to a certain degree The number of gastrosteges anterior to this was found to vary to the amount of ten scales in different individuals

In respect to the scutæ of the head, it may be said that little variation was found The shape of the rostral, vertical, nasals, etc , presented little perceptible differences in the several individuals However, the number of post-oculars was found to be different in different snakes and on opposite sides of the same snake In column 6 of the table these variations are shown The first number represents the scales on the left side, the second number those on the right side of the snake. Where the figures are the same, as *e g* , 3–3, there is no variation in the number of postoculars on the two sides of the head

The number of longitudinal rows of scales was found to vary in each specimen and in different parts of the same specimen Thus, in tracing a row of scales from head to tail, the row would often end in a V-shaped plan, formed by the approximation of the rows lying on either side of the row in question The same was true of the mother Therefore no attempt was made to tabulate them.

The plate on page 184 shows the 33 young from a dorsal view They should be counted from right to left to correspond with the table It will be seen that the color pattern varies in the different snakes. All gradations, from regularly arranged saddle-shaped markings to chain-like figures are found. The greatest irregularity in the markings occurs in the region over the heart The post-occipital collar is entire in some, as in specimen No 1 ; in others, such as No 12, this collar is cut into lateral moieties, all gradations existing between the two

If Cope's conclusions are correct that, in reptiles at least, color variations arise posteriorly and advance anteriorly, the regular arrangement of markings is later and the irregular the more primitive

This brief study has shown how variable some of the characters really are Some of these characters are used in classification, and varieties and even species have been proposed which were founded on no more fundamental characters than these The

Number of specimen	(1) Length from snout to tip of tail	(2) Length from snout to anal plate	(3) Length from anal plate to tail	(4) Number of gastrosteges	(5) Number of gas. to umbilicus	(6) Number of postoculars	(7) Bifid gastrosteges
1	265 mm	195 mm	70 mm	146	129	3-3	
2	261	203	58	146	129	3 3	30 + 33
3	265	197	68	147	130	3-3	
4	243	189	54	143	124	3 3	116, 135
5	244	191	53	147	132	3-3	147
6	252	195	57	144	126	3 3	143
7	274	207	67	150	133	3 2	
8	261	197	64	142	127	2-2	
9	260	193	67	143	128	2 2	
10	253	199	54	146	129	3-3	28, 29, 30
11	265	198	67	145	128	2-2	
12	253	197	56	143	127	2 2	
13	261	194	67	146	130	3-3	
14	259	194	65	144	125	2-3	33
15	245	190	55	143	127	3-3	142
16	254	189	65	142	126	3-3	
17	270	200	70	146	131	2-2	
18	257	194	63	144	128	2-2	
19	267	201	66	142	126	3-3	30,31,32,141
20	263	197	66	145	127	3 2	
21	247	194	53	147	129	3 3	1, 2, 3
22	256	195	61	147	132	3 2	
23	249	190	59	144	126	2-2	
24	248	195	53	148	132	2-2	
25	250	185	65	145	130	3 3	
26	261	203	58	146	128	3 3	
27	259	194	65	143	128	2 2	
28	255	199	56	145	128	3 3	
29	264	197	67	144	128	3-3	
30	268	198	70	143	123	2 2	
31	247	190	57	144	125	2-2	
32	250	192	58	144	128	3 3	143
33	257	198	59	147	127	3-3	146
Maximum	274 mm	207 mm	70 mm	150	133	3-3	
Minimum	243	185	53	142	123	2-2	
Difference	31	22	17	8	10	1-1	
Mode	261	194-197	67	144	128	3-3	
Mean	257	195	63	144	128		

two species, *amoenus* and *helenæ* of the genus Carphophiops are examples, they were separated by the former having two pairs of frontals and the latter one pair

A study of the young of the forms of *Eutaenia* would be interesting and profitable as a means of arriving at some conclusion as to the status of the several species and varieties

The writer is indebted to Prof Herbert Osborn for the photograph reproduced herewith

MYRIOPODS FROM VINTON, OHIO

MAX MORSE

The following list represents a small collection of myriopods taken at Vinton, Gallia county, Ohio, from June 19 to 23, 1901 The list is not meant to be exhaustive, but to simply show what forms are commonly found in that locality One species, Scolopendra woodii Mein, is not common in Ohio as far as our experience shows It is a member of the same genus as the well-known western and southern form known commonly as the "centipede" Our species, however, is much smaller Its bite is well directed but not serious, the main symptoms being acute pain for awhile after being bitten, with little or no swelling The millipede, Fontaria coriacea Koch, was found with eggs attached to the ventral surface The eggs were about 80 mm in diameter and were translucent

DIPLOPODA

Spirobolus marginatus (Say)
Parajulus pennsylvanicus (Brandt)
Cambala annulata (Say).
Callipus lactarius (Say)
Polydesmus serratus Say
Scytonotus granulatus (Say)
Euryurus evides (Bollm)
Fontaria coriacea Koch

CHILOPODA

Mecistocephalus sp
Scolopendra woodii Mein
Theatops posticus (Say)
Lithobius multidentatus Newp.
Lithobius providens Bollm

BOTANICAL CORRESPONDENCE AND NOTES FOR AMATEURS, II.

Conducted by W. A. KELLERMAN.

Item 5. In a paper read before the Society for Plant Morphology, an outline of which was published in Science, 13: 250, M. A. Carleton stated that the peculiar, thick-walled, one-celled spores of Puccinia vexans Farlow, after repeated failures, had been germinated. They are, however, not properly uredo spores nor teleuto spores, according to Mr. Carleton, but "partake of the nature of both. They make a distinct new spore for this order of fungi, and may be called *amphispore.*"

Item 6. Arthur and Holway, in their descriptions of American Uredineæ, III, have very commendably extended and varied the use of signs for designating the spore stages of the Uredineæ. As is well known, the Roman numerals I, II and III have long been used to designate respectively the æcidium, the uredo, and the teleutosporic stage (usually called black rust, Puccinia, Uromyces, etc.). To this series has been added *O* for the spermagonia. In the article alluded to still another sign is introduced, namely, X for the amphispores. The authors indicate relative abundance of spores in their Exsiccata by the use of both capitals and lower case letters—the former for maximum and the latter for minimum quanties. Thus, for example, i, ii, III, would indicate small proportion of æcidium and uredo, but a maximum amount of the teleutospores; iii, X, would denote a minor quantity of teleutospores and a major amount of amphispores.

Item 7. A Manual of Botany has just been published which should be in the hands of every teacher of this subject, and every botanical student, pupil and amateur should also possess a copy. It is up to date in every respect, contains all the flowering plants and vascular cryptogams of our region, gives keys to the orders, keys to the genera and keys to the species. The well-known author, Dr. N. L. Britton, has described every clearly recognized and distinct form as a species; he has also enumerated many varieties, these usually with quite ample diagnoses. The book is indispensable to the student of American botany, and no one interested in our flora can afford to be without it.

Too much praise cannot be accorded the publishers. The paper is thin but good; the binding is durable yet light; the names stand out black and bold; the type for descriptions is clear; the covers not awkwardly stiff; the number of pages 1,080, and yet the book is only an inch and three-eighths thick; even more remarkable for a book of this character and quality, the price is only two dollars and twenty-five cents.

The full title is as follows Manual of the Flora of the Northern States and Canada, by Nathaniel Lord Britton, Ph. D. The author is the director-in-chief of the New York Botanical Garden and Emeritus Professor of Botany in Columbia University. The publishers are Henry Holt & Co , New York, and the price is $2 25

Item 8 A beginner asks, ', what a double citation of authors signifies'', he wishes to know also the reason for occasional "duplication of a generic name'' for the species Examples of the two cases, taken at random, are as follows

1. Grape Fern , Botrychium virginianum (L) Sw.
2. Marsh Muhlenbergia, Muhlenbergia racemosa (Mx) B S P
3. Kentucky coffee tree , Gymnocladus dioicus (L) Koch
4. Upland white Aster, Aster ptarmicoides lutescens (Hook) Gr.
5. Indian mallow , Abutilon abutilon (L) Rusby.
6. Dandelion ; Taraxacum taraxacum (L) Karst

In brief explanation of the above the following may be stated

1. Linnaeus named this plant Osmunda virginiana, but it is not an Osmunda as that genus is now understood, and Swartz placed it in the genus Botrychium
2. Muhlenberg placed this grass in the genus Agrostis, with the name Agrostis racemosa, and it was afterwards changed to its proper place by Britton, Stearns and Poggendorf
3. The Kentucky coffee tree was first given a botanical name in 1753 by Linnaeus , then when the genus Gymnocladus was proposed the plant was rechristened Gymnocladus canadensis (a name used in Gray's Manual) by Lamarck in the year 1783 , the first specific name was restored – according to the rule of priority now generally recognized by naturalists – by Koch in 1869
4. This variety of aster was named by Hooker as Diplopappus albus var. lutescens , then Torrey and Gray placed it in the genus Aster with the specific name A lutescens, and Gray subsequently published it as Aster ptarmicoides var lutescens, hence the citation as given in the later publications
5. The Indian mallow was first enumerated by Linnaeus as Sida abutilon in 1753, in his Species Plantarum The genus Abutilon was published by Gaertner in 1791. This plant is an Abutilon as botanists interpret that genus , it was only lately (1894) that Dr. Rusby restored the original specific name, which is abutilon, but the fact that it is similar in form to the now recognized generic name does not invalidate it in the opinion of most American botanists
6. The Dandelion was given in Linnaeus's Species Plantarum as Leontodon taraxacum, 1753 ; then Weber named the plant Taraxacum officinale, 1780 , later Desfontaines called it Taraxacum dens-leonis, 1800 , it was Karsten, 1883, who properly restored the original specific name, this being the same in form as the generic name long since recognized by all botanists.

NOTES ON NEUROPTOID INSECTS.

JAMES S HINE

MANTISPA INTERRUPTA Say. This species was described by Thomas Say from a single specimen which was taken near Philadelphia. Only a few specimens have been mentioned in literature since Hagen and Uhler have mentioned variations in the wing markings of different specimens, and both have stated that the specimens that they have studied lack the "quadrate, dark fuscous spot" which Say observed on the "submargin" of the wing, and Uhler says "I have seen a specimen in which the apical spot of the wing is absent"

In Trans Am. Ent Soc., 24 23, Banks tabulated our North American species and separated sayi, which he described as new, from interrupta by the absence of markings on the wings of the former.

In the collection before me are two males and a female which I identify as interrupta, and on which this note is based

One male was taken at Sandusky, Ohio, by Prof Osborn, the other male at Vinton, Ohio, by myself, June 10, 1900, from the trunk of a small tree, while Mr Morse took the female at Vinton, June 20, 1901, by beating oak foliage. Thus one male and the female were taken at the same place, though in different years, while the other male exactly agrees with the Vinton male in size, coloration and all other characters that I have observed.

In comparison the general coloration of the body of the female is lighter than in the male, the dark costal margin is present in both sexes alike, and extends to where the costa begins to bend toward the apex of the wing Otherwise the male wing is entirely transparent, but the female wing has a reddish patch at the apex, and two darker markings outside of the costal border. These latter markings include the cross veins that meet the radius from behind at nearly a right angle. The venation in the male is noticeably darker than in the female, the former measures 19 mm, and the latter 27 mm to the apex of the wing.

SIALIS INFUMATA Newm. and americana Ramb Since S americana appears to be rare generally, I give a short comparison of its characters and habits with those of S infumata, which is an abundant and widely distributed species. The latter is common about the middle of May at Columbus, and during the day is to be found in numbers clinging to the small branches of shrubs and trees in the vicinity of streams, with its wings placed roof-like over its back. The only time I have ever taken americana it was found resting on the trunk of a large oak tree that stood near the water of Stewart's Lake, in Portage County, Ohio, June 20, 1900. Nearly a dozen specimens in all were taken.

The two specimens may be separated at a glance by general coloration; infumata approaches a black, while americana is reddish. Neither of these colors exactly fits the case, but the latter species is much lighter than the former.

S. americana has femora red, head with red streaks and spots surrounded by black and about seven veins crossing from costa to subcosta before the latter unites with the radius

S. infumata has head and femora black, and about eleven veins crossing from costa to subcosta before the union of the latter with the radius, and the antennæ are slenderer and shorter than in the above species

The two are about the same size, although from the material I have before me, americana averages slightly larger.

BITTACUS OCCIDENTIS Walker In my paper on "Panorpidæ," in Bull. Sci. Lab, Den. Univ, II: 141, I mentioned three instances where this species had been taken at light in the evening. Two more have since come to my notice and the specimens are before me

Miss Braun, of Cincinnati, took several specimens August 23, 1900, in a shady dooryard in a residence portion of the city These specimens are supposed to have been attracted to the vicinity by the street light J C. Hambleton, of Columbus, took the species at light at West Jefferson, Ohio, in August

It may be mentioned that these are the first records of the taking of this species in Ohio

DONATIONS TO OHIO STATE UNIVERSITY.

The Botanical department received a fine lot of Fayette county plants for the Ohio Herbarium from E D. Coberly and J Paul Long, but these have not heretofore been acknowledged

Mr Otto Hacker's large and splendid contribution was partially recorded in the last number of the OHIO NATURALIST

Mr. Earl Hyde, of Lancaster, has our thanks for fifty-six Fairfield County plants.

Mr S E Horlacher, of Dayton, has just contributed twenty Montgomery County plants to the State Herbarium. The excellency of the specimens calls for special mention, and they are fully appreciated.

Dr L M. Norman has sent twenty-one specimens of spermatophytes collected by him in Champaign County, for which we return thanks.

Miss Ruth E Brockett, Rio Grande, has added to her former valuable donations five herbarium specimens, among which Gerardia paupercula (Gr.) Britt is especially interesting as southwardly extending the reported range of this species.

MEETING OF THE BIOLOGICAL CLUB.

Monday Evening, December 2, 1901.

The Biological Club met in Orton Hall, and was called to order by the President, Prof. Mills

Under the head of personal observations Prof. Hine reported the duck hawk as a new campus bird, it was captured in Townshend Hall The Zoological department has received lately a fine specimen of cassowary from Sells Brothers, it will be mounted and placed in the museum. Mr. Tyler reported finding a species of Sphagnum on the shale cliffs north of Worthington.

In the reports on current literature Prof Schaffner reviewed Mr Pieters' paper on "The Flora of Lake Erie" Prof Osborn called attention to the bulletins of the New York State Museum, Nos. 46 and 47.

Prof Schaffner read an interesting paper on the "Self-Pruning of Woody Plants" Many woody plants get rid of their superfluous twigs in this way, and occasionally these twigs are cut off while green, so that green leaves are carried down with them A cleavage plane is usually formed, but in the willows a brittle zone is formed near the main branch which answers the same purpose.

Mr Morse gave a paper on the "Reptiles of Ohio," in which he gave a review of the lists so far published The first list was published in the Ohio Geological Survey of 1838 This includes twenty-seven reptiles, about two-thirds of the number that we now know from the state Dr. Smith listed thirty-six species Prof. Cope, in the Report of the U S National Museum for 1898, gives thirty-three reptiles, and Jordan's Manual gives forty reptiles and twenty-seven batrachians that might occur in the state

"The Caladium Rust" was the subject of the next paper by Mr. Jennings. This rust is said to appear only on the leaves and petioles and on the spathe of various species of Araceæ He had found it, however, on the inner surface of the ovulary of Arisæma triphyllum

Mr V. H. Davis was elected to membership. The club then adjourned.

F. J. TYLER, *Secretary*.

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COLEOPTERA OF CUYAHOGA COUNTY, OHIO.

M BUBNA

CICINDELIDÆ

Cicindela 6-guttata Fab , c[*]
var violacea Fab , r
patruela Dej , r
purpurea Oliv , a
limbalis Kl , r
vulgaris Say, c
repanda Dej , a
var. 12-guttata Dej , c
punctulata Fab , a

CARABIDÆ

Carabus limbatus Say, r
Calosoma scrutator Fab , a
calidum Fab , c
Elaphrus ruscarius Say, c.
Nebria pallipes Say, a
Scarites subterraneus Fab , c
Clivina impressifrons Lec , r
Bembidium variegatum Say, c
laevigatum Say, c
Patrobus longicornis Say, r
Pterostichus stygicus Say, c
punctatissimus Rand , c
permundus Say, c
sayi Brulle, c
lucublandus Say, r
corvinus Dej., c.
Amara fulvipes Dej , c
exarata Dej., r
impuncticollis Say, c.
obesa Say, r
Diplochila major Lec , r
Dicaelus elongatus Bon , r
Calathus gregarius Say
opaculus Lec
Platynus hypolithus Say, c
angustatus Dej , c
cincticollis Say
extensicollis Say, c
melanarius Dej
cupripennis Say, c
nutans Say
placidus Say
crenistriatus Lec
punctiformis Say
picipennis Kirby
Atranus pubescens Dej
Casnonia pennsylvanica Linn , a
Galerita janus Fab , a
Lebia grandis Hentz, c
atriventris Say, c
Coptodera aerata Dej , r
Cymindis cribricollis Dej , r.
Chlænius erythropus Germ
sericeus Forst , c.
tricolor Dej , c
pennsylvanicus Say, c
tomentosus Say, c

Anomoglossus pallipes.
Nothopus zabroides Lec
Agonoderus lineola Fab , c
Harpalus viridiaeneus Beauv , a.
caliginosus Fab , a

---

[*] a, abundant , c, common , r, rare

Harpalus faunus Say.
vagans Lec
pennsylvanicus DeG., c
var compar Lec
herbivagus Say.
Selenophorus gagatinus Dej.
Stenolophus ochropezus Say
Anisodactylus rusticus Dej.
harrisi Lec
discoideus Dej
baltimorensis Say, c.
sericeus Harr., c
interstitialis Say, c

HALIPLIDÆ

Cnemidotus edentulus Lec., c

DYTISCIDÆ

Laccophilus maculosus Germ., r
Coelambus nubilis Lec., r
Hydroporus modestus Aube, c
Ilibius biguttalus Germ
Coptotomus obscurus Sharp, r
interrogatus Fab
Copelatus glyphicus Say, c
Agabus disintegratus Cr., c
reticulatus Kirby, r.
Rhantus binotatus Harr., r
Colymbetes sculptilis Harr., r
Dytiscus hybridus Aube, c
fasciventris Say, c
Acilius fraternus Harr., r
mediatus Say, r
Thermonectes basilaris Harr., r
Cybister fimbriolatus Say, c

GYRINIDÆ

Gyrinus ventralis Kirby, c
Dineutes assimilis Aube, c

HYDROPHILIDÆ.

Helophorus lineatus Say, r
Hydrophilus ovatus G. & H
triangularis Say, c
nimbatus Say, c.
mixtus Lec., r
glaber Hbst., c.
Hydrocharis obtusatus Say, r
Hydrobius fuscipes Linn., r.

SILPHIDÆ.

Necrophorus americanus Oliv., r
orbicollis Say, r.
marginatus Fab., c
tomentosus Web., c.
Silpha surinamensis Fab., c.
lapponica Hbst., c
inaequalis Fab., c.
noveboracensis Forst., c

STAPHYLINIDÆ.

Listotrophus cingulatus Grav., c
Creophilus villosus Grav., c.
Staphylinus vulpinus Nordm., c
maculosus Grav., c.
cinnamopterus Grav., c.
violaceus, c
Philonthus aeneus Rossi, c
cyanipennis Fab., c.
Xantholinus cephalus Say, c
Cryptobium pallipes Grav., r
Paederus littorarius Grav., c
Tachinus memnonius Grav
fimbriatus Grav
Conosoma pubescens Payk
Oxyporus major Grav., c.
Acidota subcarinata Er

COCCINELLIDÆ.

Megilla maculata DeG., c.
Hippodamia glacialis Fab., c
convergens Guer., r
13-punctata Linn., c
Coccinella 9-notata Hbst., c.
Adalia bipunctata Linn., c
Anatis 15-punctata Oliv., c
Chilocorus bivulnerus Muls., c
Brachyacantha ursina Fab., c

EROTYLIDÆ.

Languria gracilis Newm
Dacne 4-maculata Say, c
Megalodacne fasciata Fab., c
heros Say, c
Mycotretus sanguinipennis Say.
Tritoma humeralis Fab
flavicollis Lac.

CUCUJIDÆ

Cucujus clavipes Fab., c
Brontes dubius Fab., r

MYCETOPHAGIDÆ.

Mycetophagus punctatus Say
flexuosus Say.

DERMESTIDÆ

Dermestes lardarius Linn., c.
vulpinus Fab., c
Trogoderma ornatum Say.

HISTERIDÆ

Hololepta fossularis Say, r.
Hister carolinus Payk., c.
lecontei Mars., c
Saprinus assimilis Payk.

NITIDULIDÆ.

Phenolia grossa Fab., c.
Omosita colon Linn., r.
Cryptarcha ampla Er.
Ips fasciatus Oliv
sanguinolentus Oliv.

TROGOSITIDÆ.

Tenebrioides corticalis Melsh., c.

BYRRHIDÆ

Cytilus sericeus Forst , r.

PARNIDÆ.

Dryops lithophilus Germ.

ELATERIDÆ.

Adelocera marmorata Fab., c.
Alaus oculatus Linn , c
Cryptohypnus planatus Lec , r
Elater nigricollis Hbst , c.
Drasterius elegans Fab., c.
Ludius attenuatus Say, c
abruptus Say, r
Agriotes mancus Say, r.
Melanotus fissilis Say.
Limonius agonus Say
Corymbites cylindriformis Hbst., c.
Melanactes piceus DeG., c.

BUPRESTIDÆ

Chalcophora virginiensis Drury, r
Dicerca divaricata Say, c.
Chrysobothris femorata Fab., c
Agrilus ruficollis, c.

LAMPYRIDÆ

Calopteron typicum Lec., c
Lucidota atra Fab., c.
Ellychnia corrusca Linn , r.
Pyropyga decipiens Harr , c.
Photuris pennsylvanica DeG., c.
Chauliognathus pennsylvanicus DeG., c.
Podabrus rugulosus Lec., r.
basillaris Say
tomentosus Say, c.
Telephorus carolinus Fab.
lineola Fab.
bilineatus Say, c.

CLERIDÆ.

Cymatodera bicolor Say, r
inornata Say, r.

PTINIDÆ.

Eucrada humeralis Melsh.
Trichodesma gibbosa Say.

LUCANIDÆ.

Lucanus dama Thunb., c.
placidus Say, c.
Dorcus parallelus Say, c.
Platycerus quercus Web., r.
depressus Lec., r.
Ceruchus piceus Web , r.
Passalus cornutus Fab., c.

SCARABÆIDÆ.

Canthon lævis Drury, c.
Copris minutus Drury, c.
anaglypticus Say, c
Phanæus carnifex Linn., r
Onthophagus hecate Panz, c
pennsylvanicus Harold, c.
Aphodius fossor Linn., c.
fimetarius Linn , c
granarius Linn., c
inquinatus Hbst., c
Geotrupes splendidus Fab., c.
semiopacus Jek , c
Trox capillaris Say.
unistriatus Beauv
scaber Linn,
Serica vespertina Gyll
Macrodactylus subspinosus Fab
Lachnosterna fusca Froh , a
crenulata Froh., r.
tristis Fab , c.
Strigoderma arboricola Fab.
Pelidnota punctata Linn , a
Cotalpa lanigera Linn , c
Polymœchus brevipes Lec.
Cyclocephala sp ?
Xyloryctes satyrus Fab., r
Euphoria fulgida Fab , r.
inda Linn., c.
Osmoderma eremicola Knoch , c.
scabra Beauv , c
Trichius piger Fab
bibens Fab
Valgus canaliculatus Fab., r.
squamiger Beauv.

SPONDYLIDÆ.

Parandra brunnea Fab., c.

CERAMBYCIDÆ.

Orthosoma brunneum Forst , r.
Prionus laticollis Drury, r.
Criocephalus agrestis Kirby, r.
Physocnemum brevilineum Say, r.
Phymatodes variabilis Fab., r.
Merium proteus Kirby, r.
Callidium æreum Newm.
Chion cinctus Drury.
Eburia quadrigeminata Say.
Romaleum rufulum Hald., c.

Elaphidion mucronatum Fab.
parallelum Newm.
Cyllene pictus Drury, c
robiniæ Forst, c
Plagionotus speciosus Say, r.
Arhopalus fulminans Fab
Neoclytus erythrocephalus Fab.
Clytanthus ruricola Oliv., c
Desmocerus palliatus Forst., c.
Encyclops cærulus Say
Rhagium lineatum Oliv
Centrodera decolorata Harr
Toxotus cylindricollis Say, r
Anthophilax attenuatus Hald.
Acmæops bivittata Say.
Gaurotes cyanipennis Say.
Typocerus velutinus Oliv., r.
Leptura lineola Say, r.
zebra Oliv, c.
proxima Say, c
biforis Newm
vittata Germ., c
pubera Say.
scripta Lec
ruficollis Say.
Psenocerus supernotatus Say.
Monohammus titillator Fab., r
scutellatus Say, r
confusor Kirby, r
Dorcaschema alternatum Say, r.
nigrum Say, r.
Goes pulchra Hald, r
debilis Lec
pulverulenta Hald., r
Acanthoderes decipiens Hald, r.
Leptostylus aculiferus Say, r
commixtus Hald
Liopus variegatus Hald.
Urographis fasciatus DeG
Acanthocinus obsoletus Oliv.
Pogonocherus sp ?
Eupogonius tomentosus Hald
Dorcasta cinerea Horn.
Saperda obliqua Say, r
calcarata Say, c.
candida Fab; c.
vestita Say, c.
tridentata Oliv., c
puncticollis Say.
mœsta Lec., r.
concolor Lec., r
Oberea bimaculata Oliv., c.
schaumi Lec, r.
Tetraopes tetraophthalmus Forst., c.

CHRYSOMELIDÆ

Donacia proxima Kirby, c.
subtilis Kunze, c

Orsodachna atra Ahr
Lema trilineata Oliv, r.
Criocerus asparagi Forst.
12-punctatus Linn.
Babia 4-guttata Oliv., c.
Bassareus detritus Oliv., c.
mammifer Newm
Pachybrachys viduatus Fab, r
Fidia viticida Walsh, c.
Chrysochus auratus, c, usually on dogs-bane—last summer on Mel. alba, c
Paria 4-guttata Lec, r
thoracica Melsh, c
Colaspis flavida Say, c
tristis Oliv, c.
Doryphora clivicollis Kirby, r
10-lineata Say, c
Chrysomela suturalis Fab, c.
elegans Oliv., c
scalaris Lec, r.
bigsbyana Kirby, c.
Gastroidea polygoni Linn., c.
cyanea Melsh., very rare.
Lina lapponica Linn
scripta Fab, r.
Luperus meraca Say, c
Diabrotica 12-punctata Oliv., c.
vittata Fab., c
Trirhabda canadensis Kirby
Galeruca decora Say, r
Oedionychis thoracica Fab
Disonycha collaris Fab, r
Crepidodera helxines Linn., c
Orthaltica copalina Fab.
Systena hudsonias Forst, c
Microrhopala vittata Fab
Cassida bivittata Say, c
Coptocycla guttata Oliv, c.
aurichalcea Fab., c
Chelymorpha argus Licht, c.

TENEBRIONIDÆ

Nyctobates pennsylvanica DeG, c
Scotobates calcaratus Fab., c.
Xylopinus saperdioides Oliv., r
Tenebrio obscurus Fab, c.
molitor Linn, c.
castaneus Knoch., c.
tenebrioides Beauv., c.
Blapstinus interruptus Say.
metallicus Fab.
Uloma impressa Melsh., c
Hoplocephala bicornis Oliv., c.
Platydema ruficorne Sturm.
Boletotherus bifurcus cand. Fab, c.
Helops micans Fab., r.
Meracantha contracta Beauv., c.
Strongylium tenuicolle Say, r.

CISTELIDÆ.

Hymenorus niger Melsh.
Cistela brevis Say.
Capnochroa fuliginosa Melsh.

LAGRIIDÆ.

Arthromacra ænea, Say, c.

MELANDRYIDÆ

Tetratoma truncorum Lec., r.
Penthe obliquata Fab., c.
    pimelia Fab., c
Melandrya striata Say, c
Eustrophus bicolor Say, c.
    tomentosus Say, c
Orchesia castanea Melsh., c.

ŒDEMERIDÆ

Asclera ruficollis Say

MORDELLIDÆ

Tomoxia bidentata Say, c
Mordella octopunctata Fab., c

PYROCHROIDÆ.

Pyrochroa femoralis Lec., r
Dendroides canadensis Lat., r

MELOIDÆ

Meloe angusticollis Say, r
Macrobasis unicolor Kirby, c
Epicauta vittata Fab., c.
    cinerea Forst., c
    pennsylvanica DeG., c

OTIORHYNCHIDÆ.

Tanymecus confertus Gyll.

CURCULIONIDÆ.

Ithycerus noveboracensis Forst., r
Phytonomus punctatus Fab.
Listronotus caudatus Say
Lixus concavus Say, c.
    musculus Say
Gymnetron teter Fab.
Conotrachelus nenuphar Hbst., c
Rhyssematus lineaticollis Say.
Pseudobaris farcta Lec
Balaninus nasicus Say, r

BRENTHIDÆ

Eupsalis minuta Drury, r.

CALANDRIDÆ.

Sphenophorus ochreus Lec., c
    pertinax Oliv., c.
    sculptilis Uhler, c
    parvulus Gyll., c

SCOLYTIDÆ.

Xyloterus politus Say, c

ANTHRIBIDÆ

Cratoparis lunatus Fab., c.

Cleveland, Ohio, 8 Heina St

CLIMBING PLANTS OF OHIO.

ALICE DUFOUR.

Climbing plants comprise all those which ascend by means of support. There are two classes—the twiners which coil spirally around a support and the climbers proper which cling to a support by means of tendrils, leaf-stalks, rootlets, re-curved bristles or other devices. In all these plants, the lowest internodes are erect, beyond which the peculiar characteristic manifests itself by the movement of the free end towards the support. If the support is a wall, the climber usually sends out roots or tendrils bearing disks which adhere to the surface. If the support is other than a flat surface, the climber usually raises itself by tendrils. These tendrils often have the form of a reversed spiral, which mechanism permits the plant to be swayed back and forth by the wind without injury.

When the plant is a twiner, it assumes a somewhat horizontal position after the first node and the extremity begins to revolve to the right or to the left. Solanum revolves in either direction· Humulus, Lonicera and Polygonum, to the right; Phaseolus and Convolvulus to the left. These revolutions are often accomplished within two hours.

The structure of the stem of the twiners differs from that of the climbers and of erect plants in order to meet the strains of tension and of pressure caused by the growth of the support of the perennials. Hollow stems are rare; the pith is usually much reduced, or the central tissues surrounded by firmer tissue which protects from pressure.

It will be noticed that all plants having annual stems climb thin supports, thus getting up to the light rapidly as the energy must be used in the growth of stem and leaves rather than in forming large circles.

The provision for exposure to light is further shown in leaf-arrangement. Leaves of plants covering flat surfaces are usually spread out parallel so as to expose as much surface as possible, and in cases of unsymmetrical leaves, the lacking portion would have been covered by those overlapping. In some, there is an arrangement of large and small leaves—two rows of small ones growing in the gaps between the two rows of large ones. In others, exposure is obtained by different lengths of petioles.

At present Dr. Kellerman's catalogues show 77 climbing plants for Ohio. Of these, 25 are woody, 52 herbaceous; 51 perennial, 1 biennial, 25 annual; 43 twiners, 34 climbers of which 24 have tendrils, 3 rootlets, 3 re-curved bristles, 3 iritable petioles, 10 are parasitic with minute suckers; 60 are native, 17 are introduced. These plants are:

Smilax herbacea, an herbaceous climber by means of tendrils, annual above ground.
Smilax rotundifolia,
hispida,
glauca, woody climbers by means of tendrils.
Dioscorea villosa, herbaceous twiner, perennial.
Humulus lupulus, herbacious twiner, perennial, from Europe.
Polygonum convolvulus, herbaceous twiner, annual, from Europe and Asia.
cilinode,
scandens,
dumetorum, herbaceous twiners, perennial.
Clematis virginiana,
viorna, herbaceous climbers by means of petioles, perennial.
Menispermum canadense, woody twiner.
Adlumia fungosa, herbaceous climber by means of petioles, biennial.
Rosa setigera, woody climber by means of recurved prickles.

Lathyrus venosus,
ochroleucus, herbaceous, perennial, with tendrils.
Phaseolus polystachys, herbaceous twiner, perennial.
Dolichos lablab, annual twiner from India.
Vicia cracca,
americana,
caroliniana, herbaceous perennials climbing by tendrils.
sativa,
angustifolia, annuals climbing by tendrils, from Europe.
Falcata comosa,
pitcheri, herbaceous twiners, perennial.
Apios apios, herbaceous twiner, perennial.
Strophostyles helvola, herbaceous twiner, annual
Rhus radicans, woody climber by means of rootlets
Celastrus scandens, woody twiner.
Cardiospermum halicacabum, herbaceous climber by tendrils, annual, from tropical America.
Vitis labrusca,
aestivalis,
bicolor,
vulpina,
cordifolia, woody climbers by tendrils.
Ampelopsis cordata, woody climber by tendrils.
Parthenocissus quinquefolia, woody climber by tendrils and roots.
laciniata, woody climber by tendrils.
Ampelamus albidus, herbaceous twiner, perennial.
Cynanchium nigrum, herbaceous twiner, perennial.
Vincetoxicum gonocarpus, herbaceous twiner, perennial
Quamoclit quamoclit,
coccinea, herbaceous twiners, annual, from tropical America.
Ipomoea pandurata, herbaceous twiner, perennial.
lacunosa, herbaceous twiner, annual
purpurea,
hederacea, herbaceous twiners, annual, from tropical America.
Convolvulus sepium,
repens,
japonicus, herbaceous twiners, perennial, two native and one from Japan.
Cuscuta epilinum,
epithymum,
arvensis,
polygonorum,
indecora,
coryli,
cephalanthi,
gronovii,

Cuscuta compacta,
    paradoxa, herbaceous twiners, annual, the first and second from Europe, the others native.
Solanum dulcamara, herbaceous twiner, perennial, from Europe and Asia.
Lycium vulgare, woody climber by means of recurved bristles.
Bignonia crucigera, woody climber by tendrils.
Tecoma radicans, woody climber by roots.
Galium asprellum, herbaceous annual climbing by recurved bristles.
Lonicera caprifolium,
    hirsuta,
    glaucescens,
    dioica,
    sullivantii,
    sempervirens,
    japonica, woody twiners, the first from Europe, the last from Asia, the rest native
Micrampelis lobata, herbaceous climber by tendrils, annual
Sicyos angulatus, herbaceous climber by tendrils, annual
Cucurbita pepo ovifera, herbaceous climber by tendrils, annual, from tropical America
Passiflora lutea, herbaceous climber by tendrils, perennial.

New York City

DONATIONS TO THE O. S U. MUSEUMS.

Supt. Thos. Bonser, Carey, Ohio, has sent 256 plants to the State Herbarium during the past month.

Mrs Theano W. Case has donated 110 specimens of flowering plants

Rev, H. Herzer, Marietta, Ohio, contributed 175 specimens to the State Herbarium.

Arnold Arboretum, Boston, Mass., sent 24 packets of seeds of rare shrubs and trees for planting.

E. B. Williamson, Bluffton, Ind., 12 specimens of four species of Odonata. Cotypes of Gomphus hybridus, recently described as new by Mr. Williamson, were included.

A fine male specimen of the fur-seal has been donated, and will be mounted for the zoological museum.

MALLOPHAGAN RECORDS AND DESCRIPTIONS.

HERBERT OSBORN

III. LOUSE OF THE RUSTY GRACKLE.

Docophorus barbatus n. sp.

Elongate, head and thorax red brown, abdomen fuscous brown. Length 2 mm.

Head much narrowed in front of antennæ, the margin slightly incurved; clypeus convex in front, clypeal signature long, narrow behind, clypeal space bordered by sinuate chitinous bars, trabecule conic, anterior border scarcely sinuate, antennæ small, first joint thick and short, second longest. Border of head with five bristles in front of antennæ, two long bristles and two short minute hairs on border behind antennæ, and four very minute hairs on occipital border Prothorax quadrate, anterior angles rounded, postero-lateral angles nearly rectangular, hind border slightly convex, a long bristle in angle, metathorax with prominent lateral angle and with three or four strong bristles Abdomen elongate ovate, scarcely wider than head, fasciæ broad, fuscous brown, each segment with marginal row of strong bristles, terminal segment with distinct incision

The male genitalia are slender, the terminal segment almost truncate with a few stiff bristles on apical margin, the segment being dark below and the abdominal fasciæ nearly continuous above

This species presents some quite remarkable similarities to speotyti Osb., especially in the clypeal structure and the excision of terminal segment in the female, and were there not apparent certain constant differences I should be tempted to think it that species and its occurrence on the grackle accidental The shape of head, terminal segment of male and genitalia differ, and I conclude they must be distinct Collected from the rusty grackle, Scolecophagus carolinus, at Lincoln, Nebraska, by Professor Lawrence Bruner.

IV NEW SPECIES AND RECORDS IN COLPOCEPHALUM AND PHYSOSTOMUM.

Colpocephalum pectinatum n sp

Light brown with conspicuous ocular and occipital spots Length 2 mm

Head of usual form; anterior border strongly convex, about six minute hairs and one long bristle in front of the antennæ, postero-lateral lobes with three long bristles and several small hairs. Occipital spots connected by a brown band, but no distinct connecting band with the ocular spots Prothorax with prominent lateral angles, a strong bristle and a small hair at extreme angle and six bristles on the hind border. Metathorax with long marginal bristles. Legs unicolorous, the hind femora with three combs of minute teeth. Abdomen elongate ovate, with faint brownish transverse bands and a row of marginal bristles; third segment below with two combs of minute hair-like teeth on each side, a little nearer the margin than median

OHIO NATURALIST *Plate 14.*

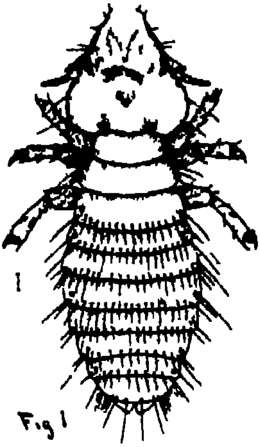

Fig 1

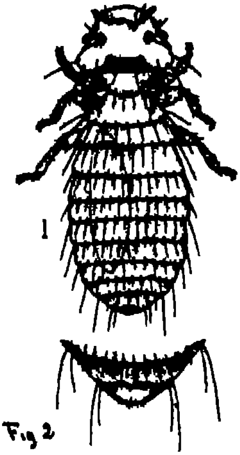

Fig 2

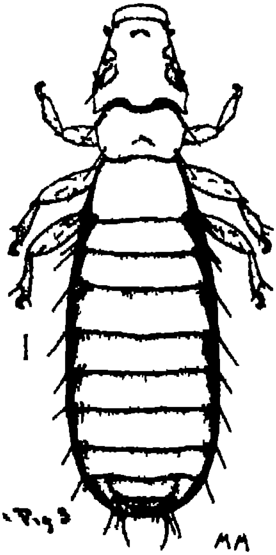

Fig 3

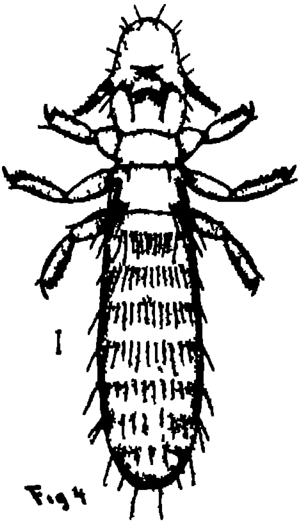

Fig 4

OSBORN ON MALLOPHAGA.

line, each comb with about ten teeth Penultimate ventral segment with a median process and ciliate border terminal segment of female with fine ciliate border

Described from a number of specimens collected from the burrowing owl Speotyto cunicularia hypogæa by Prof Lawrence Bruner Lincoln Nebraska

The peculiar combs of fine hair like teeth on the third segment of the abdomen while not confined to this species are with other characters quite distinctive and are of special interest as showing the range of morphological features presented by members of this group Since noting them in this species I find Piaget had described similar combs on the femora of his pectiniferum a species occurring on Milvogos pezoporos Of these he says four to 5 petits peignes dont les dents diminuent insensiblement de longuer He makes no mention of combs on the abdominal segment which in my species have a very similar structure About the only function that can be assigned to them is that of assisting in holding the body in definite positions in its attachment to the feathers

Colpocephalum spinulosum Piag var *minor* Kellogg (New Mallophaga III p 112)

A female specimen from the American dunlin Tringa alpina pacifica from Prof Bruner Salt Lake Haggard corresponds so closely with the form described by Kellogg from Calidris arenaria Pacific Grove Cal that I do not hesitate to so place it

Colpocephalum laticeps Kellogg (New Mallophaga I p 149)

Kellogg described this species from one male taken from Ardea egretta I have one mature female and three immature individuals taken at Ft Collins Col by A C Stephenson from the American bittern Botaurus lentiginosus which agree in almost every detail and description as separate species would seem unwarranted In shape markings and distribution of hairs and bristles there is scarcely any difference but the meta thorax is narrower and the lateral margins more strongly colored than shown in Kellogg s figure Length of male is given as 1 72 and this female is nearly 1 80 mm

Physostomum hastatum n sp

Occipital angles with distinct hooked angle margins of abdomen brownish the disk with a broad brownish stripe Length 3 mm

Head with the front expanded submargin convex with numerous bristles the labral lobes (palettes) large projecting much beyond the margin of the

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EXPLANATION OF PLATE 14

Fig 1 Docophorus barbatus n sp Female dorsal view
Fig 2 Colpocephalum pectinatum n sp Female ventral surface of posterior segments below
Fig 3 Physostomum hastatum n sp Female dorsal view
Fig 4 Lipeurus marginalis Osb Description page 176 ante
Figures by Max Morse under direction of the author

head when out-turned; palpi reaching slightly beyond border of head; antennae minute, antennal cavities marked by distinct brown borders; ocular fleck conspicuous, occipital angles produced and with a distinct hook. There are two minute hairs on the border in front of antennal pit, three just behind ocular fleck and two longer bristles between fleck and occipital angle about equidistant from each other—the fleck and the angle. Thorax broader than long, rather deeply concave in front and shallowly concave behind, the lateral angles prominent and with a bristle and two minute hairs; postero-lateral angles rounded, with bristle and one minute hair. Metathorax with about four minute hairs on lateral border, anterorly two long bristles on postero-lateral border. Abdominal segments with brown marginal stripe narrowing on eighth segment, a light brownish discal area extending from base to near the tip and covering about half the width of the segments.

This species agrees in coloration with diffusum var. pallidum Kellogg, but is much smaller than his measurements for diffusum, and the distinct hook of occipital angle would seem to separate it from that form. From sucinaceum, which it resembles in size, it is distinguished at once by the narrower front of head, different shape of occipital angles and number of bristles and the marginal abdominal bands.

Described from three specimens, females, two from the Oregon junco, Junco hyemalis oregonus, Ft Collins, Colorado, collected by A. C. Stephenson, and one from Junco aikeni, Ft Robinson, Neb., from Prof. Lawrence Bruner. It would seem probable that this form and Kellogg's diffusum var. pallidum must be closely related, but so far as present specimens go they seem quite distinct.

It is somewhat remarkable that in this genus nearly all descriptions have been from females only; only four species, so far as I have noted, referring to males, a fact that would seem to indicate that the males are quite rare or manage to escape quickly from dead birds, though the females also are usually taken in but small numbers.

Physostomum diffusum Kellogg.

Kellogg has described this species from specimens taken from the Sandwich sparrow, Ammodramus sandwichensis, and the golden-crowned sparrow, Zonotrichia coronata.

Specimens evidently belonging here have been sent me by Prof. Bruner, taken, one female from the Lincoln sparrow, Melospiza lincolni, Lincoln, Nebraska, and one female and one male from the Savanna sparrow, Ammodramus sandwichensis savanna, Lincoln, Nebraska. The male is smaller than the female, 3 mm. long, and is lighter colored, the abdomen clear white or transparent, the genital fork inconspicuous faint brown, the ends of the prong broad and rounded, a more distinct brown, crescent-shaped genital ring.

OHIO FUNGI. FASCICLE II.

(Nos 17-42, issued Feb 22, 1902.)

W A. KELLERMAN, Ohio State University.

The following species constitute Fascicle II

17. Aecidium peckii DeToni, on Onagra biennis (L) Scop
18. Gloeosporium equiseti E. & E , on Equisetum robustum R Br.
19. Gymnoconia interstitialis (Schlecht) Lagh , on Rubus nigrobaccus Bailey
20. Gymnoconia interstitialis (Schlecht) Lagh. Supplement to No 19
21. Gymnosporangium clavipes Cke & Pk , on Crataegus crus-galli L
22 Gymnosporangium macropus Link, on Malus coronaria (L) Mill
23. Melampsora populina (Jacq) Lév , on Populus deltoides Marsh
24 Piggotia fraxini B & C , on Fraxinus pennsylvanica Marsh
25 Polystictus molliusculus Berk , on rotten Beech log.
26 Puccinia angustata Peck, on Scirpus cyperinus (L.) Kunth
27 Puccinia asparagi DC., on Asparagus officinalis L.
28. Puccinia caricina DC , on Carex trichocarpa Muhl.
29. Puccinia circaeae Pers , on Circaea lutetiana L
30 Puccinia helianthi Schw , on Helianthus tuberosus L
31 Puccinia malvacearum Bertero, on Althaea rosea Cav.
32. Puccinia xanthii Schw , on Xanthium canadense Mill.
33 Stereum versicolor (Sw) Fr , on rotten Beech log.
34. Urocystis occulta (Wallr) Rabh , on cultivated Rye, Secale cereale L
35. Uromyces caryophyllinus (Schrank) Schroet , on Dianthus caryophyllus L.
36 Uromyces euphorbiae Cooke & Peck , on Euphorbia dentata Michx
37. Uromyces hedysari-paniculati (Schw) Farl , on Meibomia viridiflora (L) Kuntze.
38. Uromyces junci (Desm) Lév , on Juncus effusus L.
39 Uromyces lespedezae (Schw) Peck , on Lespedeza hirta (L.) Ell.
40. Ustilago hordei (Pers) Kellerm & Swing , on Hordeum sativum Jessen.
41. Ustilago syntherismae Schw , on Panicum proliferum Lam
42. Ustilago tritici (Pers.) Jensen, on Triticum sativum Lam

For the loan of literature, transcripts of some original descriptions, identifying species and verifying determinations, I am indebted to the mycologists, Messrs. Arthur, Ellis, Farlow, Holway, Lloyd, Morgan, Thaxter and Trelease. The eighteen species of Uredineae were submitted to the inspection of Dr. Arthur, but Dr. Thaxter identified the two species of Roestelia I return thanks to all those who have generously rendered me assistance.

The following paragraphs exhibit the labels with data and copy of the original descriptions :

17. Aecidium peckii DeToni.

Aecidium oenotherae Peck
On Onagra biennis (L) Scop
Columbus Ohio June 5 1901
Coll W A Kellerman

Aecidium oenotherae n sp Spots orbicular scarcely thickened reddish purple sometimes stained with yellow peridia short crowded generally with a small free central space spores pale orange subglobose small [illegible] in diameter Chas H Peck Report on the State Cabinet State of New York 23 60 1872

18. Gloeosporium equiseti E. & E

On Equisetum robustum R Br
Logan Hocking Co Ohio Oct 8 1894
Coll W A Kellerman

Gloeosporium equiseti E & E Acervuli large (1 mm in diameter) subconfluent covered by the blackened cuticle which soon whitens out except around the margin spores cylindrical slightly curved multinucleate 25 35 x 3 mmm expelled in pale amber colored masses Journal of Mycology 4 52

19. Gymnoconia interstitialis (Schlt) Lagh.

Caeoma interstitiale Schlecht Aecidium nitens Schw
Uredospores only
On Rubus nigrobaccus Bailey
Columbus Ohio June 2 1901
Coll W A Kellerman

Caeoma (Uredo) interstitiale n sp Folia quae infestat hoc Caeoma caeteris haud affectis remanent multo minora et minus evoluta Maculas in superiori foliorum pagina in planta sicca conspicere nequeo Acervi in pagina inferiore in nervorum interstitiis positi oblongi lineares confluentes fere totum interstitium occupantes prius parum elevati convexiusculi epidermide tecti quae postea rima longitudinali irregulariter rumpens pulverem in siccatis luteum liberum reddit epidermidis vero fragmenta ad latera undulatim resistunt Sporidia irregularia rotundata effoeta pellucida saepius lineis obscuris varie intricatis impleta parum inter se cohaerentia Schlechtendal in Nees von Esenbeck Horae Physicae Berolinensis 96 1820

Aecidium nitens Sz A simplex elongatum peridiis maximis flavis splendentibus demum irregulariter ruptis pulvere aurantio

In foliis petiolis et ramis junioribus Rubi strigosi frequens Plantas totius regionis ita investit perenne redux ut tandem omnino destruat aestate Ad Uredines accedit sed peridium distinctum habet Peridia demum inter se confluunt L D de Schweinitz Synopsis Fungorum Carolinae Superioris (excerpta) p 43 No 458 1822 (Schrift d Nat Gesellschaft zu Leipzig)

Caeoma Aecidium luminatum L v S Folia quae cum tota planta ab hoc Aecidia infestantur (semper quidem ejusdem anni) omnino degenerata L D de Schweinitz Transactions of the American Philosophical Society Philadelphia New Series 4 293 1834

20. Gymnoconia interstitialis (Schl.) Lagh.

Caeoma interstitialis Schlecht ; Aecidium nitens Schw
Spermagonia only
On Rubus nigrobaccus Bailey
Columbus, Ohio May 5, 1901.
Coll. W. A. Kellerman.
Supplement to No 19.

21. Gymnosporangium clavipes Cke. & Pk.

Roestelia aurantiaca Peck.
On Crataegus crus-galli L.
Vinton, Gallia Co , Ohio July 10, 1901
Coll W. A Kellerman.

"Roestelia aurantiaca Peck —Peridia deeply seated, cylindrical, fragile, soon lacerated, fugacious, white , spores subglobose, bright orange, about 001′ in diameter, with a thick hyaline epispore " Chas H Peck, Report of the New York State Museum (Report of the Botanist), 25 91 1872

22. Gymnosporangium macropus Link.

Aecidium pyratum Schw
On Malus coronaria (L.) Mill
Lakeside, Ottawa Co , Ohio Sept. 10, 1901.
Coll W A Kellerman.

"Caeoma, Aecidium, Pyratum, L v S —C. maculis in pagina superiori orbiculatis, rubris in ambitu ochraceis, centro nigrescentibus In aversa pagina apparent pseudoperidia creberrima, subconcentrica, parum tantum elevata margine eleganter multifido-fimbriato , fimbriis rectis, nullimodo revolutis, divergentibus, pallidis Sporidus fuscis " L D de Schweinitz, Transactions of the American Philosophical Society, Philadelphia, New Series, 4 294 1834

23. Melampsora populina (Jacq.) Lev.

Lycoperdon populinum Jacquin , Uredo longi-capsula DC., Melampsora tremulae Tul
I Uredo only
On Populus deltoides Marsh.
Columbus, Ohio. October 5, 1902.
Coll. W A. Kellerman

Jacquin gives, Collectanea Supplement., Pl 9, Fig. 2, only the following: "*Folium Populi balsamiferae in parte supina, quae obsidetur in numeris Lycoperdis minutissimis et parasiticis, folia pessumdantibus*," and Fig 3, "Pars hujus folii ad lentem aucta "

"Uredo longi-capsula Cette espèce naît sous l'épiderme, le perce et forme des taches distinctes, arrondies ou oblongues, bordées dans leur jeunesse par les débris de l'épiderme ; la poussière est très-abundante, jaune comme dans l'uredo rouille, mais elle en diffère parce que ses capsules, au lieu d'être ovoides, sont très-elongées et cylindriques ; leurs deux extrémités sont obtuses " DeCandolle, Flore Française, 2 233. 1815

24. Piggotia fraxini B. & C.

On Fraxinus pennsylvanica Marsh
Lakeside, Ottawa Co , Ohio. Sept 19, 1901.
Coll W A Kellerman.

"Piggotia fraxini B & C Perithecus hic illic caespites punctiformes congestis , sporis oblongis minutis

"Hypophyllous Perithecia collected two or three together into little rugged dot like groups, spores minute oblong " M J Berkeley, Grevillea, **3** 7 September, 1874

25. Polystictus molliusculus Berk.

On rotten Beech log
Columbus, Ohio Oct 30, 1901
Coll W A Kellerman

"Polyporus (Anodermei) molliusculus, n sp , imbricatus pileis effuso-reflexis sublobatis leviter zonatis albis , zonis strigis mollibus sparsis ornatis , contextu albo , poris mediis pallidis

"Imbricated thin 5 inches or more long, 3 inches broad, sometimes perfectly resupinate, more generally with the border broadly reflected and slightly lobed, finely silky or nearly smooth, with zones of soft strigae, which in the dried plant are perfectly innate Substance white thin, corky when dry

"Pores 1-48 of an inch broad, at first entire with thick dissepiments, at length lacerated and elongated, wood colored " M J Berkeley, London Journal of Botany, **6** 320 1847

26. Puccinia angustata Peck.

On Scirpus cyperinus (L.) Kunth
Sugar Grove, Fairfield Co , Ohio October 12, 1901
Coll W A Kellerman

"P angustata Peck Hypogenous , spots pallid or none , sori oblong or linear, sometimes regularly arranged at equal intervals in long parallel lines, narrow, surrounded by the ruptured epidermis black , spores narrow, oblong-clavate or elongated, septate above the middle, strongly constricted, having the lower cell more narrow than the upper and cylindrical or slightly tapering downwards, .0018′ .0024′ long .0006′ broad , peduncle colored, thick, very short " Chas H Peck, Report on the State Museum, State of New York, **25** 123 1872

27. Puccinia asparagi DC.

On Aspargus officinalis L , plants grown from seed sown in the spring of 1900
Columbus, Ohio April 10, 1901
Coll. W A Kellerman

"Puccinia asparagi Elle est assez commune en automne sur les tiges les branches, et les feuilles de l'asparage officinale , elle forme des taches ovales ou plus souvent oblongues, brunes, convexes , l'épiderme se fend longitudinalement , les puccines sont insérées et fortement fixées sur un réceptacle dur et charnu , chacune d'elles est composé d'un pédicelle blanc qui soutient un péricarpe oblong, obtus, à 2 loges séparées par un étranglement très-prononcé " DeCandolle, Flore Française, **2** 595 1805.

28. Puccinia caricina DC.

On Carex trichocarpa Muhl
Columbus, Ohio October 12, 1901
Coll W A Kellerman

"Puccinia caricina Cette puccinie diffère de l'*uredo caricina*, comme la puccinie des graminées diffère de l'*uredo rubigo-vera*, elle forme, a la surface supérieure des feuilles de plusieurs espèces de carex, des pustules ovales, petites, nombreuses, souvent disposées en series longitudinales, dans leur jeunesse elles soulèvent l'épiderme, puis le rompent et restent entourées de ses débris, leur couleur est brune à leur naissance, et devient noire a la fin de leur vis, les plantules qui les composent, vues au microscope, offrent un pédicelle blanc filiforme, et uns capsule en forme de massue allongée, presque cylindrique, à deux loges separées par une cloison et un petit étranglement, la supérieure est plus arrondie et un peu plus grasse que l'inférieure" DeCandolle, Flore Française, 6 60 1815

29. Puccinia circaeae Pers.

On Circaea lutetiana L.
West Alexandria, Preble Co., Ohio July 3, 1901
Coll W A. Kellerman

"Circaeae, cespitosa, globosa dilute badia,—clavulis ovato-acuminatis (In fol Circ lutet)" C H. Persoon Roemer's Neues Magazin, 1 119 1791

30. Puccinia helianthi Schw.

On Helianthus tuberosus L.
Teleutospores only
New Plymouth, Vinton Co, Ohio October 10, 1901
Coll W A Kellerman
Supplement to No 10

31. Puccinia malvacearum Bertero.

On Althæa rosea Cav
Perry, Lake Co, Ohio July 15, 1601
Coll F J Tyler.

"Puccinia Malvacearum P hypophylla, confertim sparsa, acervulis hemisphaericis initio epidermide persistente centro velatis, ambitu nudis rufis, subtus umbilicatis, sporidiis dense congestis, ovoideo-oblongis, levibus, fuscis, medio subconstrictis obtuse acuminatis longissime pedicellatis, pedicello hyalino P Malvacearum Bertero, Mss. Coll n. 730" Montaigne, in Gay, Historia fisica y politica de Chile, 8 43 1852

32. Puccinia xanthii Schw.

On Xanthium canadense Mill.

Columbus, Ohio. August 26, 1901.

Coll. F. J. Tyler and O E. Jennings

"Puccinia Xanthii Sz P macula tenui orbiculari pallida, subtus fusco-brunnea pallide marginata, sporidiis oblongis bilocularibus pedicellatis.

"In aversa pagina foliorum Xanthii strumarii, locis arenosis Subtus primum pallidas vesiculas, cellularum folii aemulas, exhibet, quibus diruptis et epidermide orbatis, cohaerentem pustulam fuscam exhibent sporidia, sub lente lutea, pedicello longiore quam sporidia" L D de Schweinitz, Synopsis Fungorum Carolinae Superioris (excerpta), p 47, No 500 1822 (Schrift. d. Nat Gesellschaft zu Leipzig.)

33. Stereum versicolor (Sw.) Fr.

Thelephora versicolor Sw

On rotten Beech log.

Columbus, Ohio. May 10, 1901.

Coll W A. Kellerman.

"Thelephora versicolor, pileo sessile membranaceo hirto, fasciis discoloribus, subtus laevi albido

"Helvella versicolor, acaulis, membranacea fasciis discoloribus, inferna laevis alba

"Pilei saepe plures conferti, accreti, sesseles, basi plerumque explanati, superne reflexi quasi dimidiati semirotundati, planiusculi, membranacea, rigidi, margine integri subundulati rarius incisi vestiti *hirsuti* brevi adpressa subaurea nitente, *fasciis* concentrici numerosis approximatis angustissimus ferrugineis fusco-violaceis interstincta Hymenium glaberrimum, pallide albidum" O Swartz, Flora Indiae Occidentalis, 3 1934 1806

34. Urocystis occulta (Wallr.) Rabh.

Erysibe occulta Wallr

On cultivated Rye, Secale cereale L.

Columbus, Ohio June 1, 1901

Coll W. A. Kellerman

"Erysibe occulta W, sporidiis effusis subrotundis, e centro opaco limbum pellucidum verrucosum, veluti ex aliis multo minoribus concatenatis ambeuntibus compositum circumducentibus olivaceis copiosissimis, vaginarum et glumarum faciem interaneam investientibus illasque demum longitudinaliter ruptas, tomenti velutini continui rimosi instar obducentibus

"*a Secales*, sporidiis effusis, strias vaginarum interanearum [illegible]farcientibus culmumque longitudinaliter scissum taeniatum hinc denigrantibus, hinc translucendo cinereum mentientibus" F G. Wallroth, Flora Cryptogamica Germaniae, Compendium Florae Germanicae, Sectio II, 4 212 1833.

35. Uromyces caryophyllinus (Schk.) Schr.

Lycoperdon Caryophyllinum Schrank.
On Dianthus caryophyllus L
Columbus, Ohio February 10, 1901
Coll. W A. Kellerman

"Lycoperdon caryophyllinum Halbeyfoermige weisslichte Blasen, die nach der groessern Axe zerspringen, und einen Kaffeebraunen Saamen ausschuetten" Franz von Paula Schrank, Baierische Flora, 2 668 1789

36. Uromyces euphorbiae Cke. & Peck.

On Euphorbia dentata Michx
Lakeside, Ottawa Co , Ohio September 15, 1901
Coll. W A. Kellerman

"Uromyces euphorbiae Cooke & Peck Leaves generally stained with red or purple, sori amphigenous, subrotund, slightly convex, surrounded by the ruptured epidermis, ferruginous brown or blackish-brown, spores subglobose, rough, often with a large nucleus, about 0008′ in diameter, peduncle short, hyaline" Chas H Peck, Report on the State Museum, State of New York, 25 90 1872

37. Uromyces hedysari-paniculati (Schw.) Farl.

Puccinia hedysari-peniculati Schw . Phragmidium hedysari Schw
On Meibomia viridiflora (L) Kuntze
Vinton, Gallia Co , Ohio October 11, 1901.
Coll W A Kellerman.

"Puccinia hedysari paniculati Sz P. punctiformis sparsa fusca, sporidiis ovata-globosis fuscis, pedicello longissimo filiformi pellucido

"Frequens in aversa facie foliorum Hedysari paniculati Septum in sporidio non conspicio Pedicellus filiformis, pellucidus" L D de Schweinitz, Synopsis Fungorum Carolnae Superioris (excerpta), p 48, No 503 1822 (Schrift d Nat Gesellschaft zu Leipzig)

"Phragmidium hedysari, L v S P acervulis minutis sed crebris per totum folium sparsis, epidermide innatis Sporidiis longe pedicellatis, pedicello articulato, pellucido, ceterum opacis, ovatis, obtusis, non cylindricis, obscure septatis, nec articulato-constrictis, fusco-nigris" L D de Schweinitz, Transactions of the American Philosophical Society, Philadelphia, 4 297 1834

38. Uromyces junci (Desm.) Lev.

Puccinia junci Desm
Teleutospores only
On Juncus effusus L
Junction City, Perry Co , Ohio April 10, 1901
Coll W A Kellerman

This fungus was issued by J B H J Desmazieres, Plantes Cryptogames de France, Fasc II , No 81, on the label of which no technical description is given, but the following statement is made "Elle (i e , Puccinia junci) a de grands rapports avec le Puccinia graminis auquel on pourrait la réunir comme une variété bien destincte Les capsules sont, comme dans cette espèce, en forme de massue mais les pustules qu'elles forment par leur réunion ne sont pas lineaires "

39. Uromyces lespedezae (Schw.) Peck.

Puccinia lespedezae-procumbentis, Puccinia lespedezae-polystachyae Schw
On Lespedeza hirta (L) Ell
Bowling Green, Wood Co , Ohio September 2, 1901
Coll W A Kellerman

"Puccinia lespedezae procumbentis Sz P minor subpunctiformis sparsa fuscescens prorumpens, sporidiis oblongis bilocularibus

"Passim ad folia Lespedezae procumbentis Epidermidem paginae inferioris folii in bullas elevat, post rupturam albas, pellucidas Sporidii septum exacte in medio sporidio situm et pedicellus (albidus, longior) a sporidio distinctus est " L D de Schweinitz, Synopsis Fungorum Carolinae Superioris (excerpta), p 47, No 497 1822 (Schrift d Nat Gesellschaft zu Leipzig)

"Puccinia lespedezae polystachyae Sz P minor punctiformis epidermide cincta nigra splendens, sporidiis oblongis utrinque attenuatis subbilocularibus

"Frequens in pagina inferiore foliorum Epidermide cincta Sporidia magis elongata et in pedicellum attenuata, septo vix conspicuo, cujus umbra mox pone apicem sporidii, mox inferius apparet Color sporidiorum sub lente luteus " L D de Schweinitz, Synopsis Fungorum Carolinae Superioris (excerpta), p 47 No 498 1822 (Schrift d Nat Gesellschaft zu Leipzig)

40. Ustilago hordei (Pers.) Kell. & Swing.

Uredo hordei Pers
On Hordeum sativum Jessen.
Oxford, Butler Co Ohio. June 3, 1895.
Coll W A. Kellerman

"Uredo segetum pulvere copioso nigro in graminum spiculis e glumis proveniente (Disp meth. fung , p 56)

"Reticularia segetum, fusco-nigricans graminum parasitica, intus filamentosa (Bull champ 1, pag 90 t 472 f 2)

"*a* Uredo hordei pseudoperidio subelliptico ruguloso, pulvere latente " D C H Persoon, Synopsis Methodica Fungorum, t 224 1801

41. Ustilago syntherismae Schw.

On Panicum proliferum Lam
Columbus, Ohio October 5, 1901.
Coll F J Tyler and O E Jennings

"Ustilago (Caeoma subgen Uredo) syntherismae, L v S C in vaginis etiam junioribus sese ostendit ante evolutionem Sporidiis cinereo-atro viridibus, laxissime effusis inquinantibus" L D de Schweinitz, Transactions of the American Philosophical Society, Philadelphia, 4 290 1834

42. Ustilago tritici (Pers.) Jensen.

Uredo tritici Persoon
On Triticum sativum Lam
Columbus, Ohio June 12, 1901.
Coll W A Kellerman

"Uredo segetum pulvere copioso nigro in graminum spiculis s glumis proveniente (Disp meth fung, p 56)

"Reticularia segetum, fusco nigricans graminum parasitica, intus filamentosa (Bull champ 1 pag 90 t 472 f 2)

"*b* Uredo tritici subeffusa" D C H Persoon, Synopsis Methodica Fungorum, 1 224 1801

BOTANICAL CORRESPONDENCE AND NOTES FOR AMATEURS, III.

Conducted by W A KELLERMAN

Item 9 Mr F. H Burglehaus, of Toledo, sends the following note "I have found in working over Rubus americana Britton, that the description in Gray's and Britton's Manuals—"stems annual, herbaceous, or slightly woody"—does not accurately cover the common form here All the specimens taken here have six inches or more of woody stem of previous year's growth The new flowering stems are delicate, herbaceous, generally branching from the stem of the previous year Is this generally the case in Ohio?"

Mr F J Tyler examined the specimens in the Ohio Herbarium and found "the branches coming from a stem of previous year's growth This old stem was in some cases three inches high, but mostly it had been killed to the surface of the ground, the young branches started from buds which had been protected by leaf mold or soil Probably the description in the floras referred to by Mr. Burglehaus is correct for all cases except where the plant is protected

Item 10. Occasion will be taken here to call attention to a note which Mr Burglehaus published in Torreya, 1 55, relative to specimens of Circaea lutetiana found at Toledo, July 29, 1900, with *smooth fruit* These were growing with the ordinary Circaea lutetiana, which otherwise they resembled Dr. Britton stated that "it necessitated a modification of the characters of Circaea"; it matches a specimen received by Dr. Torrey, from Agardh, collected in Scania, Sweden, and named C. intermedia, but the true C intermedia Ehrh., from Central Europe is evidently different."

Item 11. The Botanical Gazette gives a brief notice of a paper by Bernard, printed in Comptes Rendus, which is of such interest as to warrant reproduction here. "Bernard makes the surprising statement that it is his belief that the tubers of the potato are essentially galls and due to fungus infection. He shows that *Fusarium solani* is always present in the tubers, and it seems likely that this fungus causes the arrest of the terminal bud and the development of hypertrophied tissues, which become filled with starch. The author's experiments, while not yet conclusive, strongly support his theoretical conclusions, since a decided parallelism is seen to exist between the amount of tuber formation and the development of the fungus However, no cultures entirely free from fungus have yet been made Bernard notes that when the potato was introduced into France, tubers could not be produced from seed cultures, presumably because *Fusarium solani* did not then infest the soil"

MEETING OF THE BIOLOGICAL CLUB.

ORTON HALL, January 6th, 1902.

The Club was called to order by the president and the minutes of the previous meeting were read and approved. The first paper was by Prof Osborn who gave an account of the Chicago meeting of the Am Society of Naturalists

Mr Coberley followed with some observations on the winter foliage of plants growing near Georgesville, O He mentioned a number of plants which retain their foliage through the winter In discussing this paper Prof Schaffner spoke of the moth mullein, Verbascum blattaria L, as being well protected for the winter. Its leaves contain anthocyanin and also exhibit a strong geotropic curvature

Mr. Bridwell next read a paper on insect pollination of flowers. Insects belonging to the groups Diptera, Hymenoptera and Lepidoptera are the most frequent agents of pollination

Under the head of personal observations, Prof Prosser gave a report of his explorations in Nebraska and also of the summer's work on the conglomerate in northern Ohio This rock is exposed at Nelson Ledges and farther north at Thompson's Ledge and Little Mountain A large block was brought down and placed near the drive north of Orton Hall

Messrs. O L Eckman, A. P. Easton, R. L. Hyde and F. M. Surface were elected members The Club then adjourned.

F. J. TYLER, *Secretary.*

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ON THE USE OF SOME COMMON BOTANICAL TERMS.

JOHN H SCHAFFNER

The revolution which has taken place in the science of botany during the last fifty years has given to many of the older terms an entirely new meaning The following explanations are offered to indicate in a general way the proper use of some of the terms which are continually recurring in the class room and which stand for definite ideas and facts as at present recognized They will be used by the writer until something better is proposed

In the first place, it is of the greatest importance to clearly recognize the alternation of generations in all of the plants above the Thallophytes as well as in those Algae and Fungi where a true alternation exists The alternation of generations lies at the bottom of the entire evolutionary history of plants and to ignore this fact is to start with confusion as a foundation With beginners one need not go into details, but so far as one does go, so far he should tell the whole truth and leave no room for false impressions It is best to speak of the two generations and the plant individuals only as gametophyte and sporophyte and to drop such terms as sporogonium, oophore, and oophyte when speaking of the individual or of the generation. The gametophyte is the sexual generation and the sporophyte is the non-sexual one. Sex terms should be used only for the sexual generation and all sex terms should be discarded when the sporophyte generation is under discussion It is just as easy to say carpellate flower as female flower, or staminate tree as male tree In speaking of the gametophyte, if the two sexes are united in one individual the proper terms are hermaphrodite or bisexual, and unisexual when the sexes are separated Monoecious and dioecious should not be used for sexual individuals, these terms are properly applied only to the sporophyte.

Reproduction may come under three general heads 1. Vegetative propagation. 2 Reproduction by non-sexual spores. 3 Sexual reproduction in which spores are formed by the conjugation of two gametes or two coenocytes Any specialized part or branch of the gametophyte which bears the sexual organs should be called a gametophore The gametophores may be antheridiophores, archegoniophores, oogoniophores, etc The organs which bear the male and female cells are the spermary and ovary, but these may have various special names, as oogonium, archegonium, antheridium, depending upon their structure The sexual cells are gametes, and should be called spermatozoid and oosphere, or simply sperm and egg Normally these two cells must unite to give rise to a spore The union of the male and female gametes is known as fertilization This term must never be used for pollination Pollination is the transfer of a small male plant to an ovule or a stigma Sexually formed spores are either zygospores or oospores—zygospores when the uniting cells are not at all or very little differentiated from each other, oospores when they are spermatozoid and oosphere The product of coenocytic conjugations may be called coenocytic zygospores, etc The term sporophore may be used for any organ which bears sporangia, whether on the gametophyte or sporophyte Then the sporophore may be a sporophyll, or otherwise Sporophore is a general term for a spore-bearing organ or branch The sporophore may be a conidiophore, a zoosporangiophore, etc, according to the nature of the spores produced

A flower is a modified spore-bearing branch without sexual organs In some cases complete sterilization may have resulted so that no spores are produced. Such a flower is one, nevertheless, which was a spore-bearing organ in the earlier stages of its phylogeny It is sometimes difficult to distinguish between spores and brood buds, but all specialized reproductive cells should be called spores The term spike should not be used for a primative flower or shortened branch of sporophylls Such flowers may be called cones—as cone of Equisetum, Lycopod, Pine, etc The spike is an inflorescence. The flower may be either monosporangiate or bisporangiate. If it is monosporangiate it may be monoecious or dioecious These terms should be applied only to heterosporous sporophytes Monosporangiate flowers are either microsporangiate or megasporangiate In the case of Spermatophytes they may be called staminate and carpellate. Such expressions as hermaphrodite flowers, and polygamous flowers are altogether misleading. The typical flower is made up of four sets of floral organs, as follows

Fertile parts . { 1 Gynoecium—composed of carpels
{ 2. Androecium—composed of stamens

Sterile parts { 3 Corolla—composed of petals
{ 4 Calyx—composed of sepals

Gynoecium and androecium should simply mean the house or place in which the male and female plants live and thus the mistake will be avoided of implying sexuality to the carpels and stamens The term sterile should never be applied to a staminate flower It is manifestly absurd to continue to call a staminate flower sterile when it produces a large number of microspores A sterile flower is one which has lost the power of spore reproduction The term pistil is very misleading and should not be used except for a gynoecium in which the carpels are completely united. It would be better to not use it at all The parts of any cycle or whorl of the flower may be free or partly united or completely united and these conditions can be easily indicated without a special terminology The older terms in regard to the symmetry of the flower should be completely dropped and the newer ones, which accord with mathematical conceptions, be used According to Barnes, stigma, style, and ovulary are the usual parts of a carpel. Ovary should only be used for an egg-producing organ of the gametophyte If the carpels are free the ovularies are simple, but for convenience, if the ovularies of a number of carpels are united the entire structure may be called a compound ovulary with so many loculi or cavities The term cell is to be used only in its cytological sense as the unit of plant structure To speak of the cells of the ovulary or of the stamen when the loculi are meant is misleading

The ovule is originally the megasporangium and produces one or more megaspores The microsporangia are borne on the stamens and produce the microspores. The pollen grain and the embryo-sac are the male and female plants of the gametophyte generation of the seed plants, and develop from the microspore and megaspore, respectively A distinction must be made between the microspore, which is a single cell, and the pollengrain, a several-celled male gametophyte, also between the megaspore, a single cell, and embryo-sac, the female gametophyte The pollentube is not the male gametophyte, but only a part of that individual The entire structure, which develops from the microspore, is the male gametophyte. The pollengrains should not be called pollenspores, nor should the embryo-sac be called a megaspore. Endosperm should be restricted to the Angiosperms and stand for the tissue or cells which come from the definitive cell, and in such cases as the Pine the tissue which surrounds the embryo can be called what it actually is, the female thallus or female gametophyte filled with food material

The term root must be restricted to the sporophyte generation and root-hairs to hairs on real roots The terms rhizoid and hold-fast may be used for similar organs of the gametophyte The word leaf should be restricted entirely to the sporophyte Any reduced leaf may be called a bract or scale leaf For expansions on the gametophyte the term scale may be used as moss scale, liverwort scale, scaly Liverworts, etc Expanded thalli, as those in many of the red and brown Algae, and Liverworts and Mosses may be called fronds There is no need of calling a fern leaf a frond It is of the same nature as the leaf of a seed plant and should have the same terminology The term stoma should be used only for true stomata on the sporophyte Passages of somewhat similar function, but not similar structure on the gametophyte of some Liverworts may be called air passages for want of a better term It would be well to drop the term prothallus in the Pteridophytes and call the gametophyte, what it really is, simply a thallus The term germinate should be restricted to the division or budding of cells and spores, it should not be used for the breaking out of the embryo plant from the seed This process should always be called sprouting There is not even an analogy between this process and the germination of the spore

The terms photosynthesis, digestion, respiration, and assimilation should be properly applied, especially assimilation, which should refer only to the conversion of dead food materials into living protoplasm It would be very fortunate if the terms daughter cell, mother cell, and grandmother cell would always be applied to successive generations of cells produced by division Thus in the formation of the spores on the sporophyte, the cells which are differentiated and usually separated from the general tissue are spore grandmother cells These divide into two to form the two spore mother cells, which again divide, thus forming the four daughter cells which develop into the spores These grandmother cells are usually called spore mother cells, but it is better to use the term sporocyte, and if there are two kinds of spores, the cells may be called microsporocytes and megasporocytes

These are only a few of the most important terms that might be defined, but if these alone were always correctly applied, amateur students as well as those more advanced might obtain a clearer conception of the subject with much less outlay of misdirected effort

PROPOSED ALGOLOGICAL SURVEY OF OHIO.

W A KELLERMAN

Little or no attention has been paid to the Ohio Algæ, except by a few persons in a few localities, and it is therefore proposed that botanists, collectors and amateurs, unite in an effort to make known, the coming season the character and distribution of our State Algological flora. To this end all who may be interested—and it is hoped this number will include persons in every county in Ohio- and are willing to make observations and contributions are invited to send sp.cimens for examination to the Botanical Department, Ohio State University Mr W W. Stockberger of Denison University, Granville, will assist in working up the material and tabulating the results If the suggestions here are not ample,, interested parties are requested to send letters of inquiry

Many media or solutions for temporarily preserving Algae have been recommended—such as a weak solution of carbolic acid, two per cent solution of formalin, Riport and Petit's solution, one per cent. solution of chrome-alum, and camphor water (small piece of gum camphor in water)—but we have concluded that nothing is better than a tiny drop of carbolic acid in the vial of water containing the Alga

Homeopathic vials, or still better, shell vials, say two drachm capacity, with cork stoppers, will be found suitable, and large enough in most cases to contain ample material Slender forceps are very convenient for securing the Algæ and placing them in the bottles, though subtle fingers must never be underrated in natural history work. It is desirable that the collector note the habitat of each species taken and add any other notes that might suggest themselves for record.

Numbers could be written with ink on the cork stopper, but it is preferable to use paper attached to the vials A sheet of gummed paper can be obtained at any book store and this cut in narrow and short strips will be found most convenient. A continuous or serial numbering ought to be adopted by every one who sends material. No number should ever be repeated in sending natural history specimens of any kind, and the collector should always keep a record of the numbers, with notes of habits, localities, etc. If reports are desired on the material sent to the State Harbarium, they will be made, and reference to specimens will always be by number

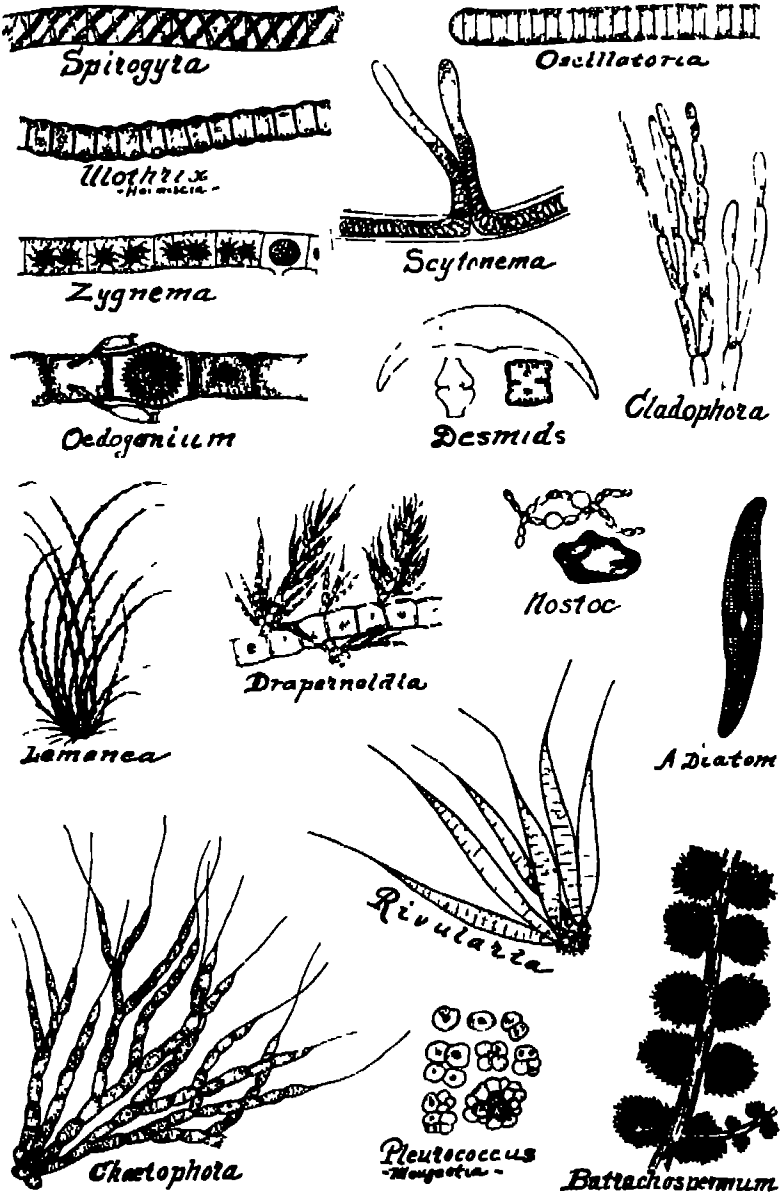
Such specimens may be sent by mail, but only when enclosed in a box so as to prevent them from being crushed and thereby endangering other mail matter The rate of postage is one cent per ounce. The name and address of the sender should be written on the outside of the package, numbers only enclosed with the specimens. Contributions are earnestly solicited.

To make exsiccata, or dried specimens, for the herbarium is a very simple matter, and I suggest a method of procedure for the benefit of those who may be interested in this phase of the work. If the Alga is a large one, for example a coarse filamentous pond-scum (Spirogyra), or very branching form from running water (Cladophora), place a small portion of the material in a basin of water. Then insert under it a piece of writing paper (book paper is not satisfactory, it must be sized), say three inches square or perhaps 2½ x 4 inches, and very slowly bring it to the surface of the water, in the meantime gently spreading out the Alga over it so as to show advantageously and naturally on the white paper For this a camel's hair brush will be found useful, particularly for spreading the more delicate filaments When the paper is lifted and drained of the excess of water, the Alga being spread satisfactorily, it should be laid in the plant-press or put between folds of paper under pressure to dry, but first spread over the specimen a piece of muslin (do not use a new piece of cloth), or worn-out handkerchief will serve as well, thus preventing the drying papers from coming in direct contact with the Alga. The next day when the mounted specimens are examined, it will be found that the Alga adheres firmly to the paper, the covering cloth being easily removed.

But for the smaller specimens, and especially for the colonies of gelatinous or slimy forms, it is preferable to use smaller pieces of mounting paper, and let the Alga dry without pressure That is, put a small quantity of the Alga on a piece of paper, leaving it exposed till all the water evaporates, when the specimen will remain attached. Small pieces of mica are preferable for such mounting, since when later the material is moistened to remove a portion for study and microscopic examination, the remainder is less disturbed than might be the case when paper is used for mounting. I usually mount specimens on both paper and mica, on the former the mass shows to better advantage.

Those who wish to make a careful study of our Algæ will scarcely find a good pocket lens sufficient even for general examination. But a compound microscope with a comparatively low objective will be quite satisfactory To study the various kinds of spore formation and modes of reproduction would be as interesting as it is difficult, but beginners and amateurs need not by reason of this hint anticipate insurmountable difficulties

The accompanying plate, will give a general though crude idea of the variety of forms that are comprised in the greater portion of our Algological flora. The delicacy and beauty of the numerous species can only be realized when one enters upon their enthusiastic study.



SKETCHES ILLUSTRATING COMMON GENERA OF OHIO ALGÆ

Appended is an alphabetical list of species hitherto reported as occurring in Ohio, the nomenclature according in the main with that used by DeToni in the Sylloge Algarum.

LIST OF ALGÆ REPORTED AS OCCURRING IN OHIO.

ANABAENA
  oscillarioides
  stagnalis
APHANOCHAETE
  repens
BATRACHOSPERMUM
  moniliforme
BOTRYDIUM
  granulatum
BULBOCHAETE
  crenulata
CHAETOPHORA
  cornu-damae
  elegans
  pisiformis
CHANTRANSIA
  pygmaea
  violacea
  violacea beardslei
CHARA
  contraria
  coronata
  flexilis
  foetida
  fragilis
  gymnopus michauxii
  intermedia
CHARACIUM
  sessile
CLADOPHORA
  crispata
  crispata vitrea
  fracta
  glomerata
  glomerata clavata
  glomerata pumila
  glomerata rivularis
  linnaei
CLOSTERIUM
  acerosum
  dianae
  lineatum
  moniliferum
  parvulum
  strigosum
COLEOCHAETE
  scutata
  soluta
CONFERVA
  bombycina
  glacialioides
  rhypophila
  tenerri rhypophila
COSMARIUM
  botrytis
  brebissonii
  biretum
  broomei
  contractum
  intermedium
  latum
  orbiculatum
  ralfsii
  seelyanum
  tinctum
CYLINDROCAPSA
  amoena
CYLINDROSPERMUM
  macrospermum
DESMIDIUM
  swartzii
DRAPARNAUDIA
  glomerata
  glomerata maxima
  plumosa
  ravenelii
EUASTRUM
  elegans
  rostratum
EUDORINA
  stagnale
EUGLENA
  viridis
GLOEOCYSTIS
  gigas
GLOEOTRICHIA
  natans
  pisum
HAEMATOCOCCUS
  lacustris
HORMISCIA
  flaccida
  subtilis
  subtilis variabilis
HYALOTHECA
  mucosa
HYDRODICTYON
  reticulatum
LEMANEA
  torulosa
LYNGBYA
  pallida
  vulgaris
MICROSPORA
  floccosa
  fontinalis
  vulgaris
MICRASTERIAS
  truncata
MICROCOLEUS
  gracilis
MOUGEOTIA
  columbiana
  genuflexa
NOSTOC
  commune
  muscorum
  rupestre
  sphaericum
  tenuissima
OEDOGONIUM
  borisianum
  capillare
  capilliforme
  cardiacum
  crispum
  cryptoporum
  fonticolum
  fragile
  gracillimum
  paludosum
  polymorphum
  wolleanum
ONOCHRONEMA
  filiforme
OSCILLATORIA
  anguina
  elegans
  froelichii
  froelichii fusca
  imperator
  limosa
  major
  nigra
  princeps
  sancta
  subtilissima
  tenerrima
  tenuis

PANDORINA
  morum
PEDIASTRUM
  angulosum
  boryanum
  simplex
  tetras
PITHOPHORA
  oedogonia
PLEUROTAENIUM
  trabecula
PROTOCOCCUS
  viridis
RAPHIDIUM
  polymorphum
SCENEDESMUS
  quadricaudatus
  polymorphus
SPIROGYRA
  adnata
  bellis
  communis
  crassa
  decimina
  dubia
  dubia longe-articu
  elongata
  fluviatilis
  grevilleana
  herricki
  inflata
  insignis
  longata
  lutetiana
  majuscula
  maxima
  nitida
  porticalis
  porticalis jurgensii
  rivularis
  setiformis
  tenuissima
  varians
  weberi
STAURASTRUM
  anatinum
  inconspicuum
  polymorphum
  pseudopachyrhynchum
STIGEOCLONIUM
  nanum
  radians
  tenue-genuinum
TETRASPORA
  bullosa
  explanata
  lubrica
THOREA
  ramosissima
VAUCHERIA
  dichotoma
  dillwynii
  geminata
  geminata racemosa
  sessilis
  terrestris
VOLVOX
  globator
ZYGNEMA
  cruciatum
  insigne
  stellinum

A NEW SPECIES OF PHYLLOSTICTA.

J. B. ELLIS AND W. A. KELLERMAN

This species was found in October on fallen leaves of the White Poplar (*Populus alba*) at Waynesville, Ohio (W. A. Kellerman), occurring in small, light-colored spots on the upper surface, and associated with an ascomycetous fungus. It may be described as follows:

PHYLLOSTICTA ALCIDES Ell. & Kellerm.—Spots cinereous, epiphyllous, subindefinite, 2-4 mm. diameter, raising and puncturing the epidermis, soon perforated above. Sporules short-fusoid or oblong, yellowish, 2-3-nucleate, 7-15 (mostly 7-10) x 3-3½ microns. Found associated with *Leptosphaeria alcides* Sacc., of which it is apparently the spermogonial stage.

"Insects Injurious to Staple Crops" is the title of an admirable compilation by Prof. E. Dwight Sanderson, of the Delaware Agr. Exp. Station, who has brought together the most essential matter regarding our principal farm crop pests in the group of insects. The work will be a welcome one to students and teachers, though it necessarily occupies a somewhat limited field, so far as school instruction goes. Its greatest service should be, as it is evidently intended to be, in enabling the progressive farmer to get the benefit of the immense advance made in methods of treating injurious insects which has resulted from the work of economic entomologists during the last decade or two.—H. O.

REMARKS ON THE STUDY OF LEAF-HOPPERS.

HERBERT OSBORN

Although the Leaf-hoppers (Jassidae) are among the most abundant of our insects and present many problems of scientific and economic importance, they have received very meagre attention from American students But very few localities in the United States have been collected with sufficient care to determine what the native species may be, and while we know that many of the species have a wide distribution, the limits of most are but very vaguely determined

The object of this note is to call attention to the group, to show how easily the species may be collected and preserved and give some hints as to the means of identification

In general the insects of the group are of small size, scarcely any exceeding half an inch in length and many are extremely minute As a result they are very inconspicuous and readily escape notice except when specially sought for. They frequent all kinds of vegetation, though in the majority of cases each species has its particular kind of food plant and generally whole genera will be limited to some particular group of plants, certain ones affecting grasses, others willows, others grape, thorn, etc

The methods of collecting must be adapted to the plants on which they occur, those living on trees being caught with an umbrella which is held inverted under branches, which are jarred by striking with a stick, or by use of a beating net of strong muslin The beating net may also be used for brushing over shrubs and rough herbage, but the most generally useful net for these insects is a sweeping net made of cheese cloth If caught in the umbrella the cyanide bottle must be in readiness to at once capture those that may be detected, as some of the species take flight very quickly Others are more sluggish and may be picked up more at leisure The sweep net after being brushed over the tops of the plants a few times is examined with the cyanide bottle held in readiness in one hand, the mouth closed with the thumb, the hoppers being taken in by slipping the bottle over them as they crawl up the sides of the net or jump from one side to the other A little practice will enable one to judge of their movements, which vary somewhat with different species, so as to hold the net in the best shape to prevent loss of desired specimens One soon learns to recognize different forms so as to capture only so many as are wanted of each kind Many of the species, however, look very much alike to the uninitiated and it is not safe to rely on general appearance till characters are known

It is better to have two or three small cyanide bottles while collecting (tubes with a mouth just large enough to be covered easily by the thumb are most convenient), and captures from different plants may then be kept separate, or in case of a large catch, one bottle may be put aside for the insects to quiet down while others are caught in another bottle When certainly dead it is well to transfer them to small pill boxes, noting plant from which they are taken on the box If the bottle becomes moist it should be kept from wetting the insects by inserting a little blotting paper or absorbent material, as the delicate species will be ruined by too much moisture To keep separate all the species that may be collected on a large number of plants may require many tubes and boxes, but the data thus secured is worth the effort and the memory should not be trusted for such data, at least until the species are well known

As soon as convenient after the insects are dead they should be sorted over, separating, if desired, the various species, and if to be packed for examination at some later date or for transmission by mail, they should be put in pill boxes in thin layers separated by soft paper, the box being filled so that no rattling is possible The papers may be cut to just fit the box and in this form data may be recorded on each slip to apply to the insects beneath it Care should be taken that specimens of the different layers may not possibly become mixed If the specimens are to be studied or mounted they may be spread out on white paper and protected temporarily by covering with a bell jar

Some of the largest species may be pinned after the usual manner, but the most satisfactory method of mounting is to glue the insect on a paper "point," which is supported on an ordinary insect pin The head of the insect should be directed forward when the point stands to the left of the pin and the label or labels with locality, date, collector's name and the food plant, when known, placed beneath The best effect is gained by pinning through the right hand edge of the label and pushing it up to near the point when the left hand edge should be about equal to the point or project very slightly beyond it I use points about 8 or 9 mm. long, just wide enough at base to hold the pin, and place them uniformly about ten millimeters from the head of the pin When arranged in series of four abreast comparison is easy and points of difference are quickly noted

The parts most used in classification may be illustrated in the accompanying figure On the dorsal part of the head, shown at *c*, the space within occiput, eyes and anterior margin is the vertex, the part shown back of the head is the pronotum the dorsum of prothorax The front of the head or "face," *b*, includes a large central portion, the front, and below this is a squarish piece, the clypeus, below which is the minute labrum resting on the beak At each side of the clypeus is a well defined area, oval or semi-elliptical in shape, the lora, between which and the eye is the gena, or cheek. The fore wing or elytron, *f*, has a triangular clavus extending along the inner or hinder part and separated from the rest of the wing by the claval suture. It includes two claval veins From the base of the wing two principal veins run toward the apex They are called the first and second sectors, or sometimes the radial and ulnar sectors The first is usually forked and the inner fork of first sector connected to the second sector by one or two transverse veins. The cells at tip of wing are the apical and those next to them the ante-apical, while those next the costal margin are costal cells The genitalia are of great importance for separating species in some of the genera The female ventral segments, *d*, show a terminal ventral segment beyond which are two side pieces, including the ovipositor. The side pieces are termed pygofers, though more properly they are the ventral margins of the pygofer or terminal segment The male, *e*, has following the last complete segment a variously shaped partial segment, the valve, following which are two plates that are usually triangular in outline and dorsal to these, usually hidden by them, are the margins of the pygofer. The larva is shown at *g* The species figured, *Deltocephalus inimicus* Say, is one of our most abundant species and occurs in blue grass over a very wide range of territory in the United States

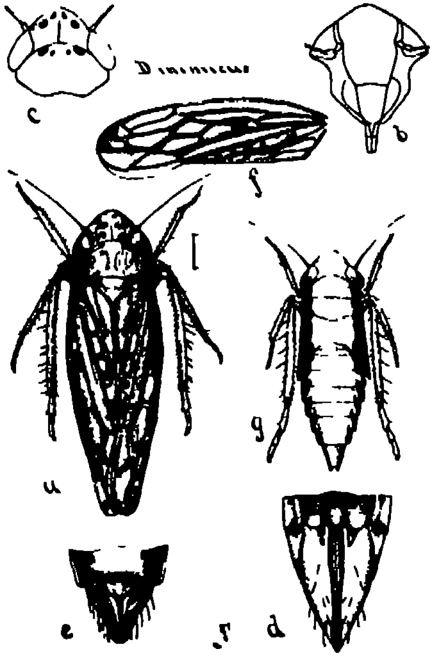


Fig. 1 *Deltocephalus inimicus* *a*, adult, natural size shown by line at right, *b* face, *c*, vertex and pronotum *d*, female genitalia, *e*, male genitalia, *f*, wing, *g*, larva
(After Osborn and Ball)

For systematic study of these insects, Van Duzee's "Synoptical Arrangement of North American Jassidae" and "Catalogue of the Described North American Jassoidea" are indispensible Scattered papers by the same author, Uhler, Fitch, Stal, Provancher, Woodworth and others are more or less essential Gillette and Baker's "Hemiptera of Colorado," Gillette's "Typhlocybinæ," Osborn and Ball's "Review of the Genus

Deltocephalus," "Review of the Genus Agallia," "The Genus Pediopsis," "The Genus Idiocerus," Ball's "Review of the "Tettigonidæ of North America North of Mexico," Osborn's "The Genus Scaphoideus," are useful for certain groups

The writer is especially interested in the species affecting grasses, and will be pleased to assist anyone who may desire to take up a study of the group, by aiding in the identification of species If preferred, specimens may be sent unmounted in pill boxes and duplicates returned, as far as time permits, and sample mounts or hints as to methods will be given those who desire to go thoroughly into study of their home fauna Collections from eastern and southern localities are especially desired

POISON IVY AND IVY POISONING.

W A KELLERMAN

Of the six species of Rhus occurring in Ohio, namely, Rhus copallina, Dwarf Sumac, Rhus hirta, Staghorn Sumac, Rhus glabra, Smooth Sumac, Rhus aromatica, Fragrant Sumac, Rhus vernix, Swamp Sumac or Poison Elder, and Rhus radicans, Poison Ivy (sometimes confused with Rhus toxicodendron, a southern species), only the two latter are poisonous These are generally so well known as to be avoided—the Poison Ivy being a suspicious-looking vine or occasionally a small, shrubby, upright plant with three leaflets It need never be mistaken for the Virginia Creeper, since the leaves of the latter are composed of five leaflets The Swamp Sumac seldom occurs away from swamps and its resemblance to the other large Sumacs generally suffice to identify it This species has not, however, a dense cluster of bright colored fruits at the end of the branches, but open, dull colored panicles below the terminal leaves

It has been determined that the poison of the two Sumacs is an oil, stable not volatile It is called "toxicodendrol," and occurs in all parts of the plant. An account of Ivy poisoning and its treatment is given in Rhodora by Dr. Pfaff, of the Harvard Medical School, from which we here summarize the more important parts

The toxicodendrol is easily soluble in alcohol, ether, chloroform, etc, but insoluble in water To prevent poisoning, immediately after contact with the plant thoroughly wash the parts with soap, using a scrubbing brush Unless the washing is thorough it might serve merely to spread the poisonous oil more widely over the skin The application of a solution of lead acetate in alcohol is recommended, which may take the place of the above It gives a precipitate of lead compound which is nearly insoluble in alcohol and can then be removed by washing.

NEW OR LITTLE KNOWN DIPTERA.

JAS. S. HINE.

NEMOTELUS PALLIPES Say.

This species was described by Say in 1823, but so far as I am aware has not been recognized since. A half dozen specimens taken near Cincinnati, June 12, of last year seem to be this species. There is slight variation, but some of the characters which Say mentioned are conspicuous, in all, the coloration agrees in general and the size corresponds exactly with Say's measurements. Some differences that might be mentioned are the coloration of the legs and ventral segments. The basal three-fourths of all the femora are black, and the middle and posterior tibiæ, except at base and apex, are usually a very dark brown, although there is some variation in the latter case. The front tibiæ are usually yellow, but even here a shade of brown is sometimes present. The rufous coloration of the posterior edges of the middle of the ventral segments is not evident, but the whole venter is a uniform black.

I am inclined to believe that this is Say's pallipes, for it seems that the conspicuous, triangular, white spot above the antennæ is a convincing character. It might be mentioned that this spot is geminate, being separated in the middle by a narrow, black space.

PACHYGASTER MACULICORNIS n. sp.

Black, lower part of front, and face next the eyes with an edging of silvery white pollen, antennæ yellow, third joint on its inner surface with a conspicuous brown spot from which the species is named, also the third joint is transverse, the perpendicular diameter being much the longest, and the slender arista appears to spring from the upper front part, although technically speaking it is apical, as all the extension of this joint is above, the antennæ have the appearance of being turned upward at the tips. Femora except at base and apex, black, remainder of legs and knobs of halteres entirely pale yellow, thorax above clothed with yellow, recumbent pile, giving a metalic appearance if viewed without the aid of a lens, wings hyaline, venation as in Pachygaster pulcher, stigma pale, abdomen with short, white hairs. Length 2½ mm. Habitat, Onaga, Kansas. Three female specimens.

We have three specimens procured by exchange from F. F. Crevecoeur. By reading the description of Zabrachia polita Coq., I conclude that the species resembles that insect, but the third vein is branched and of the usual length. Again it suggests Cympimorpha, but the scutellum is rounded at the apex. I would place it in Pachygaster without hesitation were it not for the antennæ, which seem to agree with Williston's description of the antennæ of Cympimorpha minuta, and are therefore quite different from these organs in Pachygaster pulcher. I place it here provisionally.

CRIORHINA UMBRATILIS Will.

So far as I am aware only two specimens, one of each sex, of this species have been mentioned in literature. I have seen four additional female specimens recently, three taken by Chas. Dury at Cincinnati, Ohio, and one taken by E. B. Williamson at Nashville, Tenn. Mr. Dury procured his specimens from the blossoms of thorn apple about the middle of May. Ceria, Specomyia and other desirable species were taken at the same place. It is quite probable that thorough collecting on these blossoms would yield many specimens which are considered rare. Each of the gentlemen mentioned have donated a specimen of this insect to the university museum.

TROPIDIA MAMILLATA Loew.

Loew described this species in the first century of his North American Diptera, from a male specimen taken in Illinois. The type seems to have remained the only recorded specimen up to the present time. In a collection made by J. C. Bridwell at Baldwin, Kansas, is a male which agrees perfectly with Loew's description. Through the kindness of Mr. Bridwell the specimen is now in the university museum.

PHORANTHA AND ALOPHORA.

I have had much interest in the species of these two genera for some time. They appear in large numbers in late fall, on such flowers as may remain until the middle or last of October, and especially upon the various species of Aster. A few specimens have been taken at other seasons, but as a usual thing they are rare, while hundreds of specimens of various species may be taken in October around Asters. A small patch of these plants grown on the campus by the Botanical Department were in blossom through October last fall, and Mr. Bridwell procured a large number of specimens belonging to at least six species. Near noon of warm, clear days most specimens were taken.

PHORANTHA BRIDWELLI n. sp.

Head at the vibrissæ longer than at the base of the antennæ, frontal vitta wide, brown, otherwise the front and face yellowish, covered with white pollen, facial ridges bristly below, but not all of the bristles are in the single row on each side, antennæ reaching to the middle of the face, first two joints reddish, third joint and arista brown, second and third joints of nearly equal length, front at narrowest part nearly three times as wide as the distance between the posterior ocelli, ocellar bristles small, cheeks clothed with fine, pale hairs. Thorax dark in ground color, sternum, sides and scutellum thinly gray pollinose, disk yellow pollinose, except four brown, longitudinal vittæ, which extend from the anterior part to beyond the transverse suture, the outer one on each side abbreviated before and extended behind, wing brown, base to humeral cross-vein and apex of second basal cell yellowish, which color follows the third and fifth longitudinal veins to beyond the anterior cross-vein, subhyaline spaces at apex of costal, base and apical fourth of marginal, apical third of submarginal and disk of first posterior cells, posterior border hyaline, femora and tibiæ yellowish, tarsi black Abdomen without macrochætæ, but clothed with short, black hairs, entire outer margin, including the anterior half of the first segment and all of the small posterior segment, pale brown, covered with white pollen, producing a pinkish shade, disk dark purple with a narrow, pollinose dorsal stripe, venter uniform yellowish Length, whole body, 10 mm, wing 9 mm, width of wing at base, 5 mm Habitat, Baldwin, Kansas Two male specimens taken from flowers of willow by Mr J C Bridwell, for whom the species is named

This is a very striking species, and it is with some hesitation that I locate it in Phorantha Its wide wings and general form suggest Alophora pulverea, but the bare sides of front bars it from this genus Bigot's description of fenestrata has been carefully studied and the following differences noted The coloring of the wings is a conspicuous brown, which color includes the apex, and the discal cell except the lighter margin of the fifth vein, the femora are not fuscous above and the size is larger Besides, Coquillett in his valuable study of the Tachinidæ, places fenestrata under Alophora

The January number of the *American Naturalist* contains an article by Prof J H Comstock and Mr Chujiro Kochi on "The Skeleton of the Head of Insects," which deserves the closest attention of students of the anatomy of insects Heretofore our knowledge of this subject has been in a chaotic condition, but this contribution certainly brings together what is known from different sources, combines it with original studies and presents it in such manner that some final conclusions seem safe —H O

MEETING OF THE BIOLOGICAL CLUB.

ORTON HALL, February 3rd, 1902

The Club was called to order by President Mills and the minutes of the previous meeting were read and approved President Mills exhibited a copy of an Aztec book which belongs to the series copied by Mrs. Nuttall and published by Harvard University

Professor Cook gave the results of his investigations on the embryology of the Nymphaeas and Castalias He concludes that these plants should be placed among the Monocotyls rather than the Dicotyls His paper will soon be published in the Torrey Botanical Bulletin

A series of eggs, embryos, and young of the Salmon were exhibited by Professor Landacre, who also gave an interesting account of the annual migrations of this fish

Mr. T W. Ditto and Mr J G Sanders were elected to membership The Club then adjourned. F J TYLER, *Sec'y*

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A REVIEW OF THE NORTH AMERICAN SPECIES OF ATHYSANUS (JASSIDAE.)

HERBERT OSBORN AND E. D. BALL.

The genus *Athysanus* Burm. is world wide in distribution and in many of the faunal areas is represented by a large number of species. Being one of the older Jassid genera it has like *Deltocephalus* been made the abiding place of a very heterogeneous mass of material. One by one the more strikingly distinct forms have been taken out and placed in genera of their own, leaving as a residue species whose strongest bond of union is probably their lack of distinctive generic characters upon which to separate them. As has already been suggested this confusion has been greatly augmented by the use of "the second cross nervure" as a final test between this group and the Deltocephalinae. With every addition to our knowledge this character loses in value as a correct test of the separation of these groups and is now only regarded as of limited application between different genera in each series.

Under such conditions it was found to be almost impossible to give any characters to the group that would apply to all the included species. An examination of a series from Europe showed that their fauna was even more complex than ours but that it would nearly all fall into the same groups and that most of the remaining species belonged to genera already set off in America.

In the present paper an attempt has been made to arrange the North American species still remaining in this genus in a series of groups sufficiently homogeneous in character to be defined and thus give a basis upon which to work in future studies on related genera. In the following out of this plan a few species were eliminated as more closely related to other genera and then it was found that the remainder could easily be arranged in four series on definite structural characters These characters seem to be of sufficient value to warrant subgeneric separation at least, and perhaps upon a comparative study of the related genera some of these groups may be found worthy of generic rank.

Under each species is given the reference to its original description and the original reference to any synonyms that have been published and references to any descriptive article published since the Van Duzee Catalog The bibliography in that Catalog is so complete and accurate that it has not seemed necessary to repeat it here except in one or two cases where the synonomy has been changed

Key to the Subgenera

A Vertex transverse, much wider than long, margins parallel or the anterior but slightly in advance of the eyes Anterior margin in profile obtusely rounding to front, Subg *Athysanus* Burm

AA Vertex not distinctly transverse, usually produced before the eyes Anterior margin in profile meeting front in an angle or conically produced point

B Vertex distinctly wider than its middle length, much wider than the long diameter of an eye

C Vertex and front obtusely, conically pointed, vertex convex between the eyes, front somewhat inflated, markings on vertex in the form of transverse lines or absent Subg *Conosanus* nov

CC Vertex and front angled, the vertex flat with a definite margin, front very flat in both diameters Anterior margin of vertex with four definite black spots or with two which extend below the margin onto front, Subg *Commellus* nov

BB Vertex narrow, its basal width rarely equal to its middle length, often narrower than the long diameter of an eye Species small Subg *Stirellus* nov

SUBGENUS ATHYSANUS BURM

Head broad and short, the vertex much wider than long, margins parallel or nearly so, rounding to front without a definite margin, front broad, the face very deep, but little inclined. Elytra usually rather long, compressed behind and giving a wedge-shaped appearance to the insect Venation definite, simple, but one cross nervure between the sectors, the anteapical cells usually parallel-margined

Type *A. argentatus* Fab. (European) which closely resembles *magnus* O. B.

Key to the Subgenus.

A. Size very large, width over 2½ mm, front narrowing regularly into clypeus without an angle, *magnus* Osb and Ball

AA. Size smaller, less than 2 mm in width, apex of front distinctly wider than clypeus, often twice as wide

B. Ground color white or pale straw, at least no greenish tinge, anterior margin of vertex with black spots.

C Short and stout, elytra short, nervures light, apical cells short, female ovipositor no longer than pygofers, *frigidus* Ball

CC. Longer and rather slender Elytra long, nervures dark, apical cells long, ovipositor exserted, attenuate, *exitiosus* Uhl.

BB. Ground color pale green, elytra distinctly green, vertex with transverse bands.

C Vertex slightly longer on middle than against eye, transverse band on vertex narrow and straight, *striolus* Fall

CC Vertex margins strictly parallel, transverse band on vertex broader, parallel with the margins, *parallelus* Van D

ATHYSANUS MAGNUS OSBORN AND BALL

Athysanus magnus O and B Proc Ia Acad Sc IV p 225, Pl XXVI fig 2 1897

Resembling the European *argentatus* but larger, much larger than any other of our species Vertex parallel-margined, not advanced in front of the eyes Ashy gray with a transverse white stripe across the vertex and another on the pronotum Length ♀ 8 5mm, ♂ 7 5mm, width 3mm

Vertex nearly four times wider than long, half the length of the pronotum, front broad, almost flat, triangularly narrowing from the antennae directly to the clypeus. Pronotum transverse, nearly parallel-margined Elytra distinctly longer than the body, venation typical Athysanoid pattern, usually a cross nervure between the claval veins

Color ashy gray, pronotum darker with a transverse pale yellow band just back of the middle, vertex with a pale band, elytra with the nervures distinct, margined with light, the centers of the cells irrorate with brown, costal margin creamy yellow, face brownish irrorate

Genitalia female segment as long as the penultimate, posterior margin in four rounding lobes, the inner pair smaller and separated by a triangular notch, male valve obtusely triangular, plates nearly twice the length of the ultimate segment, four times that of the valve, roundingly narrowing to the middle then triangularly produced

Habitat Minn., Ia, S Dak., Neb., Kans., Wyo and Colo. This species is readily recognized by its large size. It is almost identical in structure with *argentatus* Fab. the type of the genus *Athysanus* and which must stand as the type of the typical subgenus

ATHYSANUS FRIGIDUS BALL. (Plate 16, fig 1.)

Athysanus frigidus Ball, Ent News, X, p 172, 1899

Short and stout with a short, swollen head and almost square front Resembling *exitiosus* but much stouter. Color dirty white, four black spots on anterior margin of vertex and four more before them on the face Length ♀ 4 5mm, ♂ 4mm, width 1 5mm

Vertex over two and one-half times wider than long, half longer on middle than against eye, broadly rounding to the tumid front, front wider than long, the apex twice the width of the clypeus. Elytra broad, short, just covering the abdomen in female, slightly longer in the male, venation obscure, typical Athysanoid, apical cells scarcely longer than wide.

Color· vertex white, four large, shining, black spots on the anterior margin, the inner pair near the apex, the outer pair outside the ocelli, a pair of minute, approximate points on disc and sometimes one on either side near the base Pronotum pale straw-colored, four small spots back of the margin, the inner pair approximate, scutellum with a pair on the disc. Elytra with the nervures pale. Dark specimens may have brown stripes in the cells and along the claval sutures Face pale, a pair of quadrate spots just beneath the inner pair on vertex, a smaller pair beneath the outer ones, a pair of oblique marks near the apex of front and the suture below them, black

Genitalia female segment twice the length of the penultimate, shallowly emarginate posteriorly with a broad, slightly bilobed median process, pygofers broad, equalling the ovipositor, male valve broad, obtusely rounding, plates broad at base, regularly narrowing to the slightly divergent points, one-half longer than the ultimate segment, three times the length of the valve

Habitat Colo

ATHYSANUS EXITIOSUS, UHLER (Plate 16, Fig 2)

Cicadula exitiosa Uhler, Amer Entomol III, p 72 1880

Very variable in size and color, usually a pair of round, black spots inside and slightly below the ocelli and a pair of oblique dashes in the basal angles of the vertex Readily recognized by the entirely hyaline elytra with dark nervures and the long, exserted ovipositor in the female Length, ♀ 4-5 mm, ♂ 3.5-4 mm, width, 1 25 mm

Vertex two-thirds the length of the pronotum, half as long as its basal width, rounding insensibly into the front, front wedge-shaped below the antennae, clypeus wedge-shaped, broadest above Elytra longer than the abdomen in both sexes, slightly compressed before the flaring apex Venation Athysanoid, the apical cells long and narrow, appendix broad, extending entirely around the end of the wing entire apex of the elytra very frail and often wanting in old specimens, the appendix especially so

Color vertex pale, washed with orange, a pair of round, black spots just over the margin onto the front and a pair of oblique dashes in the basal angles, sometimes constricted in the middle, between their anterior extremities lies a brownish crescent, its anterior margin definite and parallel with the vertex margin Pronotum cinereous with four black spots back of the anterior margin, scutellum with heavy, black triangles within the basal angles and a median, posteriorly divided, stripe sometimes broken up into dots Elytra hyaline with a milky reflection, nervures narrow, dark Face pale yellow, front with two black spots on margin above, and numerous dark arcs on disc. Pale specimens may have nearly all these spots wanting except the round ones on vertex margins and the triangles of the scutellum Very dark specimens, including most of those from Mexico and the West Indies, have these marking very broad and often confluent and the elytra smoky iridescent. A variety from Hayti has the vertex creamy with a transverse band across the middle and the spots in front black in sharp contrast, the pronotum with four longitudinal stripes

Genitalia female segment twice the length of the penultimate, truncate behind; pygofers rather slender, ovipositor long, attenuately pointed, extending beyond the pygofers the length of the ultimate segment, male valve equilaterally triangular, plates very narrow, long, acutely triangular, about three times the length of the valve, their apices divergent, clothed with stout hairs.

Habitat. Abundant everywhere from Md., Ohio, Ia., Colo. and Ariz. south to the West Indies and Mexico. The most abundant species of the genus throughout the southern states.

ATHYSANUS STRIOLUS, FALLEN

Cicada striola Fall. Acta, Holm., XXVII p. 31. 1806.
Athysanus striola Van D. Can. Ent. XXI p. 11, 1889, Catalog p. 303 (*Limotettix*).
Athysanus striola Osb. and Ball, Dav. Acad. N. S. VII, p. 91, pl. V fig. 4, 1898.

Long and narrow, tapering posteriorly, resembling in form the genus *Idiocerus*, eyes wider than pronotum. Variable in size, usually smaller than *parallelus* which it closely resembles. Greenish with transverse black stripes on vertex and face. Length ♀ 4-5mm, ♂ 3.5-4mm, width 1.25mm.

Vertex slightly longer on middle than against eye, twice wider than long, over half the length of the pronotum, rounding to the broad front, profile a trifle angled before the ocelli, other structures as in *parallelus*.

Color: pale green, vertex with a transverse black stripe as in *parallelus* but narrower, leaving a broader green stripe both behind and in front and strictly transverse, not parallel with margins. Face with the black sutures, arcs and the cordate upper margin of front, as in *parallelus*, very variable in breadth and intensity. Pronotum and elytra pale green.

Genitalia: female segment half longer than the penultimate, the entire posterior margin shallowly, roundingly, emarginate, pygofers rather long, equaling the black ovipositor. Male valve broad, obtusely angular, plates about three times as long as the valve, triangular, their apices slightly divergent, much narrower than *parallelus*.

Habitat. (Europe) Ontario, N. Y., Ill., Iowa, Colo. and Vancouver's Isd. Doubtless will be found throughout the northern half of the United States and well up into Canada.

ATHYSANUS PARALLELUS VAN DUZEE

Athysanus parallelus Van D. Can. Ent. XXIII, p. 169, Cat. p. 303 (*Limotettix*).

Closely resembling *striolus* but larger and with a broader, shorter head. Pale green with a transverse band on vertex, facial sutures and arcs on front, black. Length, 6mm., width, 1.75mm.

Head with eyes wider than the pronotum, vertex strictly parallel-margined, two and one-half times wider than long, a trifle over half the length of the pronotum, roundingly confused with the almost flat face; front broader than long, much broader than the clypeus at apex. Elytra long and narrow with a distinct appendix, venation typical Athysanoid pattern, apical cells long, curved.

Color: vertex pale yellow or greenish, a transverse black band just back of the ocelli, nearly as wide as the space behind it, face with the sutures, a line on the clypeus and the arcs on the front, black. The upper margin of

front is bounded by a cordate black line, the inner ends of the arcs are united by a pair of median longitudinal lines and there is a pair of black spots above the antennae Pronotum pale green, the anterior margin darkened along the suture Elytra pale greenish subhyaline, the nervures slightly lighter

Genitalia female segment twice the length of the penultimate, posterior margin truncate, the lateral angles rounding, a triangular, median notch nearly to the middle, pygofers long, fairly stout, as long as the ovipositor Margins of the notch, the ovipositor and short hairs on the pygofers black. Male valve as broad as the ultimate segment and about as long, obtusely triangular, plates stout, a little over twice as long as the valve, and entirely concealing the pygofers, triangularly narrowing to the broad, roundingly divergent apices Entire surface thickly set with short, dark hairs.

Habitat Ontario, Iowa and Colo

Readily separated from *striolus* by the larger size, shape of the vertex and genitalia

SUBGENUS CONOSANUS NOV

Head equaling the pronotum in width, vertex broad, transversely convex, bluntly angulate before, angulate with the front, the margin obtusely rounding or the whole front and vertex united to form a bluntly pointed cone. Front somewhat inflated, broad above, regularly narrowing to a parallel margined clypeus Elytra variable, sometimes shorter than abdomen in female, sometimes longer in both sexes, always inclined to be flaring posteriorly, giving a parallel margined effect to the whole insect Venation variable, the second cross nervure often present in the species with short wings Those with long elytra have the central anteapical cell produced posteriorly and enlarged at the apex

Type of the subgenus *obsoletus* Kirschb Common to Europe and America

Key to the Subgenus

A Species stout, elytra usually shorter than or only slightly exceeding the abdomen, almost truncate at the apex, the central and anteapical cell rarely constricted and not extending posteriorly beyond the adjacent cells as far as its width at middle Color pale straw, fuscous or black

B Straw colored, stout, resembling *obsoletus*, or fuscous with a broad light spot on the cross nervure (*varius*).

C Vertex distinctly angled, twice as long on middle as at eye, as long as the pronotum

D Vertex with a straight, light line between the ocelli, separating two small triangular spots on apex from two broad obscure ones on disc Lower corners of male pygofers extending as long, style-like points, much longer than plates. *extrusus* Van D

DD Vertex with a pair of transverse bands broken forwards in the middle, male pygofers with the lower corners acutely produced but not extending beyond the plates *alpinus* Ball.

CC Vertex more rounding, distinctly less than twice as long on middle as against eye, shorter than pronotum

D Vertex unmarked, or with round spots; front broadest at base, elytra shorter than the abdomen in the female, the cross nervure not broadened *obsoletus* Kirsch

DD Vertex with transverse bands, front bounded above by a cordate line, narrow, the margins parallel half its length, elytra long and narrow, the cross nervure in a broad white spot *varus* Ball

BB Black, smaller and narrower, rarely dark brownish fuscous with light nervures but no broad light spot on the cross nervure

C Vertex distinctly angular, the margins straight, nearly twice as long on middle as against eye, a yellow band at base of vertex and usually the nervures yellow *plutonius* Uhl

CC Vertex rounding, but slightly conically pointed, but little longer on middle than at eye. Shining black, elytra coriaceous *anthracinus* Van D

AA Species smaller and usually more elongate. Elytra usually longer than abdomen, rounding posteriorly, the central anteapical cell constricted in the middle, its apex produced as far beyond the adjacent cells as its middle width. Color brownish or fulvous

B Elytra distinctly longer than body, form long and narrow. Females over four mm. in length

C Pale testaceous, the vertex fulvous, face and below including legs pale testaceous *symphoricarpae* Ball

CC Testaceous brown or brownish, transverse fuscous marking on vertex and pronotum, face and below fuscous or black, the legs partly lighter.

D Elytra pale, testaceous or cinereous, the nervures narrowly light, sometimes narrowly margined with fuscous, anterior and middle legs with the tibiae and the tips of the femora orange, rest of femora shining black *vaccinii* Van D.

DD Elytra with nervures almost white, the cross nervures broadly light. All nervures broadly, heavily fuscous margined, leaving only small stripes or spots of light in the center of the cells, anterior and middle femora and usually tibiae with alternate light and dark rings *striatulus* Fall

BB Elytra only equaling the body in length, or slightly longer in the males. Form short and stout, species smaller, less than 4mm in length

C. Vertex with a definite transverse band between the anterior margins of the eyes, species over 3 mm in length. Front broad, distinctly wedge-shaped. *arctostaphyli* Ball

CC Vertex with markings very faint, no transverse band between anterior portion of eyes. Species 3mm or less in length. Front narrow, almost parallel margined *dentatus* O. and B

ATHYSANUS EXTRUSUS VAN DUZEE

Athysanus extrusus Van D. Can. Ent. XXV p. 283 1893
Athysanus extrusus Osb. and Ball. Proc. Dav. Acad., N. S. VII p. 92, Pl. VI, Fig. 1, 1896

Larger and stouter built than *obsoletus* and with a longer vertex. Dirty straw-yellow, washed and marked with fuscous, usually four triangular, dark spots on vertex. Length, ♀ 5.2 mm, ♂ 4.2 mm; width 2 mm.

Vertex slightly obtusely angled, twice as long on middle as against the eye, as long as the pronotum, posterior margin nearly straight, transversely convex, acutely angled with front, the anterior margin blunt Front wider at base than its median length, rounding below to the clypeus Elytra broad, broadly rounding, almost truncate behind, exposing the pygofers and last abdominal segment in the brachypterous female, reaching just to the tip of the plates in the macropterous male, exposing the two style-like processes Venation distinct, typical Athysanoid or not infrequently with a second cross nervure between the sectors and a few irregular ones on clavus, apical and anteapical cells broad and short, central anteapical with the margins nearly parallel

Color vertex pale yellow, a light line between the ocelli and another along the margin to the apex on each side, forming a triangle which encloses a pair of triangular, dark spots Back of this triangle are two broad, slightly irregular spots and another pair occupy the basal angles Elytra with the nervures light, distinct, more or less margined with fuscous Face pale, the sutures dark, tips of the lorae, a pair of lines on the clypeus and about nine arcs on the front, black

Genitalia female segment nearly twice the length of the preceding, truncate on its middle half, the lateral angles acutely triangularly produced, usually clasping around pygofers, male valve obtusely triangular, equaling the ultimate segment in length and nearly in width, plates as wide as the segment, roundingly divergent to the parallel lateral margins, three times the length of valve, pygofers compressed beneath the plates, their style-like tips extending beyond them the length of the plates

Habitat Canada, N Y, N H, Conn., Mich, Iowa, Kans. and Colo The very distinct genitalia of either sex will readily separate this species

ATHYSANUS ALPINUS BALL

Athysanus alpinus Ball Ent News X, p 173 1899

Resembling *obsoletus* in size and color, with the long vertex of *extrusus* Straw yellow marked with fuscous, two transverse bands on vertex, angled forward in the middle Length, ♀ 5 5 mm., ♂ 4 5 m, width 2 mm.

Vertex as long as the pronotum, slightly obtusely angled, the margins rounding, front as in *extrusus*, the clypeus slightly narrowed towards the apex Elytra reaching the middle of the last abdominal segment in the female, slightly longer than the abdomen in the male, venation rather weak and irregular, Athysanoid, the anteapical cells parallel margined

Color vertex pale straw, a transverse, black band arising just back of the ocelli, its anterior margin angling forward nearly parallel with vertex margin, its posterior margin rounding and paralleled by another less definite band on the disc, usually a pair of irregular spots in the basal angles Pronotum pale, sometimes with four irregular, longitudinal stripes which do not reach the anterior margin. Elytra pale yellow, with the nervures light, some fuscous blotches, especially in the apical cells in the male. Face pale, about seven broad arcs on front omitting both basal and apical margins, the antennal sockets and sometimes a spot on margins of lorae fuscous

Genitalia: female segment half longer than the penultimate, the lateral angles rounded, the median third emarginate with a stout median process tipped with two divergent teeth, male valve as broad as the ultimate segment and about half as long, plates triangular, slightly narrower than the valve, three times as long, together convex, their margins slightly concave, pygofers compressed beneath the plates, the posterior angles triangularly produced, curved upwards, not extending beyond the plates.

Habitat Mountains of Colorado

ATHYSANUS OBSOLETUS KIRSCHBAUM

Athysanus obsoletus Kirschb Die Athysanus Arten v Wiesb p 7 1858
Athysanus obsoletus Prov Pet Faune Ent Can III, p 291, 1889
Athysanus obsoletus Van D Bull Buff Soc Nat Sc V, No IV, p 199, 1894
Athysanus relativus Gill and Baker Hemip Colo Bull 31, 1895

Smaller and paler than *extrusus*, with a blunter vertex Vertex shorter than pronotum, rounding in front Pale straw-yellow, sometimes with a pair of dark spots on vertex. Length, 4 5-5 mm., width, 2 mm.

Vertex rounding, half longer on middle than against eyes, two-thirds the length of the pronotum, broadly rounding to the front Front broad above, roundingly narrowing to the clypeus Elytra broad, exposing the pygofers and the ultimate segment in the female, distinctly longer than the abdomen in the male, venation Athysanoid, slightly variable, apical cells minute in female, of medium size in male The specimens from Van Couver's Island have the elytra still shorter in the female and only as long as the abdomen in the male.

Color pale straw yellow, often unmarked above, sometimes with a pair of dark spots on the disc of the vertex, and some of the cells on the elytra fuscous heightened along the margins of the light nervures, sutures of face and arcs of front sometimes broadly fuscous

Genitalia female segment half longer than penultimate posterior margin roundingly or slightly angularly emarginate one-third its depth, its apex with a small, pointed tooth; male valve small, weak, triangular, one-third the length of the ultimate segment, plates three times the length of the valve, roundingly narrowing to the broad, blunt apex, together bluntly spoon-shaped, the margin fringed with weak spines.

Habitat (Europe), Ontario, N Y, Iowa, Colo. and Vancouver's Isd. Doubtless occurs throughout the northern half of the United States and well up into Canada.

ATHYSANUS VARUS BALL

Athysanus varus Ball Can Ent XXXIII, p 5, 1901

More slender than *obsoletus*, with the elytra long and narrow, much smaller and darker than *extrusus*, with the cross nervures broadly tinged with light. Straw colored, clouded with fuscous. Vertex with transverse bands. Elytra dark, with the nervures light, cross nervures broadly so. Length, ♀ 5 mm., ♂ 4.25 mm.; width, 1 5 mm.

Vertex sloping, scarcely two-thirds the length of the pronotum, half longer on middle than against eye, front narrower above than in *obsoletus*, nearly parallel-margined until just before the broad apex, clypeus parallel-margined. Elytra longer than abdomen in both sexes, narrow and without an appendix. Venation distinct, often the cross nervure is double and other irregular cross nervures appear in the clavus.

Color: Female, vertex straw yellow, a transverse band just back of ocelli, an interrupted band either side of this. Face pale, sutures, a large spot on clypeus, arcs on the front and a cordate line at its base, black or fuscous. Pronotum variably irrorate with fuscous, usually a submarginal row of black spots. Elytra with nervures light, the cells irregularly fuscous, the cross nervures thickened and broadly white. Male much darker than the female, the apex of front, lorae and all but the base of clypeus, black. Elytra with the cells nearly black, the white nervures in sharp contrast.

Genitalia: female segment one-half longer than penultimate, posterior margin nearly truncate, median third slightly produced; male valve nearly semicircular; plates long, triangular, three times the length of the valve, side margins slightly emarginate.

Habitat: Colorado (plains).

ATHYSANUS PLUTONIUS, UHLER (Plate 16, Fig. 3.)

Jassus plutonius Uhler. Bull. U. S. Geol. Surv. III, p. 470, 1877.
Athysanus plutonius Prov. Pet. Faune Ent. Can. III, p. 282, 1889.

Much smaller and narrower than *obsoletus* and its allies. Similar to *anthracinus*, but slightly larger and lighter colored and with a more pointed vertex. Vertex distinctly, obtusely, angular. Elytra as long as the body, almost truncate behind, without an appendix. Length, ♀ 4.5 mm., ♂ 4 mm.; width, 1.5 mm.

Vertex twice wider than long, nearly twice longer on middle than against eye, slightly obtusely angular, the margins straight; pronotum rather long, half longer than the vertex. Elytra broad, rounding or almost truncate posteriorly, as long or slightly longer than the body. Venation typical, the central anteapical cell scarcely narrowed, apical ones broad and short, rarely much longer than wide.

Color: black, usually with a line on the base of the vertex, with a point extending forward on each side, a pair of oblique spots against the eyes, a few spots on pronotum, a pair of irregular stripes on scutellum and the nervures of elytra, yellow. Sometimes there is also a transverse band on disc of vertex, an angled one against the tip, fine irrorations over the entire pronotum and the centers of the cells as well as the nerves yellow. Usually in the males and sometimes also in the females all the yellow markings are wanting and the insect is of a shining black, except the basal line of vertex. Face black, the arcs on front and sometimes other markings, yellow. Legs black, the anterior and middle pairs abruptly yellow from just before the apex of femora, spines on hind tibiae, yellow.

Genitalia: female segment but little longer than penultimate, the middle half roundingly produced, the lateral angles produced and subacute; male valve stout, rounding, half the length of the ultimate segment, plates roundingly triangular, their apices slightly acute, two and one-half times as long as the valve

Habitat. Ontario, N. H., N. Y., Iowa, S Dak., Neb., Kans., Colo. and Texas.

ATHYSANUS ANTHRACINUS VAN DUZEE

Athysanus anthracinus Van D Can Ent, XXVI p 136, 1894

Form and structure of *plutonius*, but with the vertex shorter, rounding. Color black, shiny, first two pairs of tibiae, yellow Length, ♀ 4. mm, ♂ 3 5 mm, width, 1 5 mm

Vertex very broadly, obtusely conical, but little longer on middle than against eye, margin confused with front, slightly over twice wider than long Pronotum broadly rounding in front, much less enclosed by the head than in *plutonius* Elytra as in *plutonius*, slightly exceeding the abdomen, flaring at the tips Front rounding, distant from eyes above, rounding to the straight clypeus from below the antennae

Color shining black, the ocelli, two spots on the hind margin of vertex and traces of a few arcs on front, yellow Legs black, the anterior and middle pairs yellow from just before the apex of femora

Genitalia female segment as in *plutonius*, sometimes nearly truncate, with the lateral angles blunter, male valve nearly semicircular, over half the length of the ultimate segment; plates roundingly triangular, with the apices blunt, but little over twice the length of the valve

Habitat D. C, Iowa, Kans. and Colo. This and the preceding species are closely allied and can only be accurately separated by the shape of the vertex, which in *plutonius* is much more pointed and together with the eyes encloses more than half of the pronotum, while in *anthracinus* the vertex is blunter and the eyes are broader and shorter. The latter species is always black, however, while most of the specimens of *plutonius* show more or less of yellow

ATHYSANUS SYMPHORICARPAE BALL. (Plate 16, Fig 4)

Athysanus symphoricarpae Ball Can Ent, XXXIII, p 5, 1901

Longer and narrower than *plutonius* Form of *striatulus*, but larger, broader Pale testaceous inclined to reddish on vertex. Length, 4 5 mm; width, 1.25 mm.

Vertex broadly rounding, with a blunt, conical apex Elytra much longer than body, with a narrow but distinct appendix, venation as in *striatulus*, the two branches of the first sector again touching before the short, outer anteapical cell, central anteapical cell long, constricted in the middle

Color: pale testaceous, vertex distinctly reddish in most specimens, ocelli blood red Elytra pale subhyaline testaceous or with a slight olive tinge, nervures narrowly pale, the cross nervures slightly wider. Front pale testaceous, with traces of fuscous arcs. Legs and below, pale orange testaceous.

Some specimens have olive and fuscous markings on pronotum and traces of fuscous margins on some of the nervures

Genitalia female segment little longer than the penultimate, the lateral margins slightly narrowing, the lateral angles slightly produced, the posterior margin either entire and very slightly produced in the middle or truncate and sharply notched either side of the middle

Habitat Six specimens, all females, have been taken in Colo Four from Ridgeway on the west side of the Continental Divide, and two from Fort Collins on the east slope

ATHYSANUS VACCINII VAN DUZEE

Athysanus striatulus Fall (?) (or *vaccinii* nov) Van Duzee Ent Amer VI p 134 1890
Athysanus striatulus Osb and Ball Proc Dav Acad N Sc, VII p 91 Pl V Fig 5 1898

Form and size of *striatulus*, but lighter colored Smaller and narrower than *symphoricarpae*, which it approaches in color. Olive testaceous, darker below, the tips of the anterior and middle femora and all of the tibiae, orange Length, ♀ 4 5 mm, ♂ 4 mm, width, 1 mm

Vertex sloping, little longer on middle than against eye, twice wider than long. Pronotum much more produced anteriorly than in *symphoricarpae* Elytra long, appressed behind, sometimes a trifle flaring at the tip, venation as in *symphoricarpae*, the central anteapical cells long and narrow, enlarged at the apex, which is produced beyond the adjoining cells

Color pale testaceous washed with olive, vertex with three transverse fuscous bands, the anterior one broken forward in the middle, the posterior one often reduced to two spots Pronotum and scutellum with irregular, scattered fuscous spots, the latter with fulvous triangles in the basal angles Elytra pale testaceous, subhyaline, the nervures slightly lighter, often narrowly fuscous-margined. Face and below black, sutures and arcs on front light Basal two-thirds of femora black, apices and tibiae orange yellow

Genitalia female segment slightly longer than penultimate, the apical margins produced on middle third and again at the lateral angles, which are slightly acute; male valve rounding, almost semicircular, plates triangular, a little over twice the length of the valve, black, their margins clothed with long, yellow hairs

Habitat: N. J., Md., Iowa, Kans. and Colo Readily separated from the following species by the color of the legs alone For an explanation of the synonomy see remarks under that species.

ATHYSANUS STRIATULUS, FALLEN.

Cicada striatula Fall Hem Suec, II, p 45, 1826
Athysanus instabilis Van Duzee Can Ent, XXV, p 284, 1893

Size and form of the preceding species, but darker and lacking the tawny tinge, legs dark, [illegible]ora twice annulate with pale. Length, ♀ 4 5 mm, ♂ 4 mm, width, 1 mm

Vertex a trifle more pointed than in *vaccinii*, distinctly more conical than in *symphoricarpae* Elytral venation as in the latter species, sometimes a second cross nervure between the sectors as in *osborni*

Color: vertex pale yellow with three transverse fuscous bands as in *arctostaphyli*, the posterior one broken forward on each side until it touches the middle one, its median limb forming a crescent, the median line broadly fuscous connecting the crescent with the band in front. In dark specimens these bands become confluent and the yellow reduced to elongate spots between them. Pronotum thickly and irregularly marked with fuscous omitting an elongate spot on the anterior margin. Scutellum dark, usually the margins, a spot on apex, and a pair of elongate tri-lobed ones on disc, pale yellow, Elytra light the inner apical cells smoky, nervures milky white, the cross nervures very broadly so, nervures broadly, heavily margined with fuscous. In dark specimens often filling up all but a small milk white spot in the center of each cell. Face light with the sutures, arcs on front and a spot on apex of clypeus, black, or black with small spots in the middle of the facial pieces and narrow arcs light. Below dark, anterior and middle femora with two pale yellow bands.

Genitalia resembling *vaccinii*, female segment slightly less arcuate, its lateral margins and the pygofers pale yellow, male valve rounding, plates triangular, a spot on each side of the disc and stout hairs on the margin, yellow.

Habitat (Europe) N. Y., Mich. and Colo. Doubtless widely distributed in a northern range.

Specimens of *striatulus* from Europe (Dr. Melichar) agree with our specimens in every respect, except that in them the central anteapical cell is often divided while in our material this is rarely the case. The fact that this is variable in both series, however, proves it of no value.

This and the preceding species, while unquestionably distinct, are still closely related and it is little wonder that Van Duzee confused the two forms. He first found *vaccinii* and described it as *striatulus* ? at the same time suggesting *vaccinii* for it if it proved to be distinct, then later finding the real *striatulus*, but as he regarded the other as being *striatulus*, this he named *instabilis*.

Besides the more definite black and white appearance of the elytra in this species, the two pale bands on the anterior femora will most readily separate it from *vaccinii*.

ATHYSANUS ARCTOSTAPHYLI BALL (Plate 16, fig. 5.)

Athysanus arctostaphyli Ball Ent. News, p. 173, 1899.

Resembling *vaccinii* and *striatulus* in form and color pattern. Shorter and stouter with a more angular vertex. General color deep, testaceous brown. Length, ♀ nearly 4mm, ♂ 3.5mm; width 1.25mm.

Vertex slightly obtusely angulate, the apex produced, conical, twice wider than long, over half longer on middle than against eye, three-fourths the length of the pronotum. Front broad, convex in both diameters, wedge-shaped, narrowing directly to the parallel-margined clypeus. Elytra broad and short, usually flaring in the female, venation as in the three preceding species the apical cells shorter and the central anteapical not as strongly constricted.

Color: vertex tawny yellow, a line between the fulvous ocelli broken forward in the middle, a transverse band between the anterior portion of the eyes and a spot in each basal angle usually connected by a bracket-shaped mark hung from the middle of the band in front, fuscous Pronotum irregularly fuscous marked, usually a fairly definite band of spots on the anterior submargin. Elytral nervures pale testaceous, margined with fuscous, the cross nervures broader and lighter Face with the sutures, arcs on front and a spot on apex of clypeus fuscous Below dark; legs dark or sometimes annulate with pale.

Genitalia female segment half longer than the penultimate, posterior margin weakly produced in the middle and at the lateral angles, male valve semicircular, plates triangular, two and one-half times as long as the valve, the margins with coarse hairs

Habitat · mountains of Colorado and Mt. Washington, N. H. This and the three preceding species form a little group of closely related forms in which the genitalia are of little value. In fact, this and the five preceding species are much alike in genital characters and it is only on the shape of the head, elytra and color pattern that they are readily separated. The shorter and more compact form, longer head and deep chestnut color will readily distinguish this species.

ATHYSANUS DENTATUS OSB AND BALL (Plate 17, fig 5)

Athysanus dentatus Osb and Ball Proc Dav Acad Nat Sci VII p 95, 1898

Smaller and lighter colored than *arctostaphyli*, which it somewhat resembles. Pale testaceous, faint lines or spots on front margin of vertex and a wavy line on the disc forming an X-shaped figure Length, 3mm, width, 1 mm or less.

Vertex narrow, but little wider than long, roundingly angled before, nearly flat, the apex but very slightly conically produced. Face narrow, but almost parallel-margined Elytra about as long as the body, inclined to be flaring, venation often indistinct, as in *arctostaphyli*, the central anteapical cell not as strongly constricted

Color vertex pale yellow, six indistinct spots on the anterior margin sometimes united into an irregular broken line, the posterior disc with a median pale X-shaped figure and a pale spot on either side at the base, the whole margined with a continuous brown line Pronotum brownish or olive, the anterior margin yellowish, set off by a row of fuscous spots of which the median pair are the most distinct Scutellum dirty yellow with a pair of brown spots on disc in line with those on pronotum and vertex Elytra pale testaceous subhyaline, the nervures slightly lighter, sometimes a cross nervure on clavus and the [illegible] between the sectors are distinctly lighter and set off by a fuscous spot. Front testaceous with short, light arcs and a light spot below, rest of face pale yellow with sutures and spots on the apices of lorae and clypeus brownish fuscous.

Genitalia: female segment abruptly narrowed one-third the distance from the base, exposing a pair of light colored membranes, the lateral angles of segment produced into long, blunt tipped, slightly divergent teeth, between these teeth the margin is produced into two small, rounding lobes separated by a slight notch. Male valve very large, triangular, the apex slightly produced, plates much enlarged, broad at base where they are convex, extending beyond the valve about half its length without narrowing, their truncate tips standing nearly perpendicular to the plane of the valve and together with the short pygofers forming an enclosed cavity

Habitat Colorado

SUBGENUS COMMELLUS NOV

Head as wide as the pronotum, vertex angled before, flat or nearly so, angled with front and with a definite margin, not in the form of a conical point; front broad, nearly flat in both diameters, margins straight and narrowing directly to the clypeus Elytra in two forms, slightly shorter than the abdomen and inclined to be flaring, or long and parallel-margined, venation irregular, often obscured by longitudinal stripes. Sometimes the inner fork of first sector not forking again or only at extreme apex, forming a small, triangular cell, sometimes forking as usual and the second cross nervure present.

Type of the subgenus *A. comma* Van Duzee, no European representative known.

Key to the Subgenus

A Ocelli and frontal suture distant from the eye-suture, several times the width of the ocelli, spots on anterior margin of vertex extending down equally onto front and visible from below

  B. Two pair of spots common to vertex and front, stripes on pronotum black Elytra with the venation obscured by brown stripes, but one anteapical cell

    C. Four separate stripes on each elytron, anteapical cells wanting or a single minute one, *comma* Van D

    CC Eight separate oblique stripes on each elytron, one large anteapical cell, *colon* O. and B

  BB A single pair of spots common to vertex and front Pronotal stripes irregular, brownish, venation distinct, nervures light, two or three anteapical cells, *sexvittatus* Van D

AA. Front above the antennae approximating the eye Ocelli scarcely their own width from the eye-sutures (not the color line) Spots on vertex back of the margin, not visible from below

  B Vertex margin sharp, a pair of longitudinal, red stripes across vertex, pronotum and scutellum Venation obscured by oblique, red stripes, *texanus* Osb and Ball

  BB Vertex with the margin blunt, no red stripes, venation distinct two cross nervures between sectors, a divided central anteapical cell

    C Straw-colored, spots on vertex small, in a row between the ocelli. Front and clypeus without apparent suture, *osborni* Van D

    CC. Greenish yellow, spots on vertex large, the apical pair in front of the others, front inflated, with a distinct suture below, *simplarius* nov nom.

ATHYSANUS COMMA VAN DUZEE (Plate 17, Fig. 1)

Athysanus comma Van D. Can. Ent., XXIV, p. 114, 1892.
Athysanus comma Osborn and Ball. Ia. Acad. Sc., IV, p. 223, 1897.

Form broad and stout, vertex flat, roundingly right-angled, the anterior margin thick. Elytra long and parallel-margined or short and flaring. Color creamy white, four spots on the anterior margin of vertex, two at the base and four stripes on pronotum, black. Elytra with a fulvous brown band inside the broad, light margins on each side. Length, ♀ 5 mm., ♂ 4 mm., width, 2 mm.

Vertex flat, anterior angle a trifle obtuse, anterior margin thick, nearly twice wider than long, three-fourths the length of the pronotum, profile acutely angled; front and clypeus almost straight, front moderately broad above, distant from eyes, scarcely convex, lateral margins almost straight to clypeus. Elytra longer than abdomen, parallel-margined, venation usually obscure except near apex, the inner fork of first sector not forking again or only to form a minute cell, apical cells large.

Color: pale creamy, four quadrate spots shared equally by face and vertex, a pair of round ones on base of vertex and four parallel stripes on pronotum and scutellum, black. Elytra pale with the claval suture, a band just before the apex and a line on the inner branch of first sector, black, a broad, fulvous, brown band extends around within the margins, broadest behind, its inner limb is divided anteriorly to connect with the stripes on pronotum. Face and below pale, a pair of quadrate spots below the antennae, another pair below the lateral margins of pronotum and a stripe on outer half of the connexivum, black. Legs pale, narrow, dark stripes on anterior sides of all the femora and a pair of broader ones on the inner margin of the posterior tibiae.

Brachypterous form, elytra shorter than abdomen, obliquely truncate, flaring behind, the apical cells reduced to mere rudiments almost in line with the apex of clavus. Color pattern the same except that the transverse bands at the apex are narrower. The last two abdominal segments have four longitudinal, black stripes, and the pygofers have on each side a round, black spot which is connected anteriorly with a stripe forming a comma. The males have another pair of black spots on the lower corners of the pygofers.

Genitalia: female segment a little longer than penultimate; the posterior margin roundingly emarginate, with a narrow, black-margined, median slit, the lateral angles inclined to be produced; a rounding or bilobed membrane at the apex of emargination. Pygofers short and stout; male valve large, triangular, apex rounding, sides indented, plates slightly wider than valve at base, narrowing to the middle, then parallel-margined to the nearly truncate apices, twice the length of the valve, equaling the pygofers.

Habitat: It has been found in Iowa, Neb., Kans. and in Colorado as far west as the mountains, and also in the mountains of New Hampshire.

ATHYSANUS COLON OSB. AND BALL (Plate 17, Fig. 2.)

Athysanus colon Osb. and Ball. Proc. Ia. Acad. Sc., IV, p. 223, Pl. XXVI, Fig. 3, 1897.

Form and general appearance of *comma*, but with the inner fork of the first sector again forking to form an anteapical cell. Color pattern similar, but the bands on the elytra broken up into seven or eight stripes, and often a pair of black spots on the middle of the vertex. Length, ♀ 5 mm., ♂ 4.25 mm.; width, 2 mm.

Vertex slightly shorter than that of *comma*, face and profile similar, elytra similar except that the inner branch of the first sector forks again near the middle, forming a long, wedge-shaped cell, broadest behind where it touches three or four apical cells.

Color: clear, creamy white, with black spots and stripes as in *comma*, an additional pair of smaller spots on the disc of the vertex in line with the basal and apical pairs. Elytra with eight fulvous brown stripes as follows: a complete longitudinal stripe just outside the first sector and another next the claval suture, a narrow stripe between the branches of the first sector, a shorter one between the branches of its inner fork, a broadly interrupted one between the first and second sectors, a complete median stripe on the clavus, one on the outer apical half and another on the inner basal half. The apical cells and the apices of the anteapical fuscous margined.

Brachypterous form, elytra shorter than the abdomen, obliquely truncate, flaring, the apical cells minute or partly wanting, tergum and pygofers marked as in *comma*.

Genitalia: female segment slightly more emarginate than in *comma*, exposing more of the membrane beneath, male valve slightly broader, plates with the outer angles strictly rectangular.

Habitat: Only known from Iowa and Minnesota, where it is common. Readily separated from *comma* by the color and venation of the elytra. In all other points they are almost identical.

ATHYSANUS SEXVITTATUS VAN DUZEE (Plate 17, Fig. 3.)

Athysanus sexvittatus Van Duzee. Can. Ent., XXVI, p. 93, 1894.

Resembling *comma* and *colon* in form and structure. Smaller and with longer vertex, resembling *extrusus* in color and elytral venation. Vertex flat, right-angled in front, a pair of black spots near the apex and two pairs of quadrate, brown spots behind them. Length, ♀ 4.5 mm., ♂ 3.5 mm., width, 1.75 mm.

Brachypterous form, vertex flat, the anterior margin thick, slightly wider than long, as long as the pronotum. Profile acutely angled, the face nearly straight; front as in *comma*, distant from the eye at the base. Elytra short, obliquely truncate, exposing the pygofers, the last segment and part of the next in the female, rounding, exposing the pygofers and part of the last segment in the male. Venation distinct, irregular, two and sometimes more cross nervures between the sectors, the outer anteapical cell often minute or wanting, in which case the venation approaches that of *colon*.

Color · dirty straw, marked with rusty brown and olive ; vertex with a shining black spot either side at the apex, extending equally on to the front, a pair of small, round spots midway to the ocelli just back of the margin and two pairs of widely separated, quadrate, rusty brown spots on the disc. Pronotum with six more or less irregular, brownish stripes, scutellum with a pair of large spots at base and a pair of dots on disc Elytra with the nervures broadly pale, narrowly margined with rusty brown in irregular bands, usually a rather distinct, oblique one from before the middle of clavus to the outer apical margin Abdomen above with four longitudinal stripes emphasized on their margins, pygofers with a pair of black spots, larger in the male Face pale, the sutures dark-lined and distinct, front irrorate or lined with olive fuscous, legs pale, anterior and middle femora twice annulate, posterior femora lined with brown.

Genitalia female segment similar to *colon*, twice as long as the penultimate, the lateral angles acute, posterior margin slightly, angularly emarginate, the disc elevated so as to appear still more deeply notched This emargination discloses a pointed lobe of another membrane which nearly equals the lateral angles, pygofers short and stout, male genitalia as in *comma* and in *colon*

Habitat Colorado, where it is fairly common, locally, in the short-winged form No long-winged specimens have been found.

ATHYSANUS TEXANUS OSB AND BALL

Athysanus texanus Osb and Ball Proc Dav Acad Nat Sc VII p 92 1898

Form elongate, parallel-margined ; vertex flat, less angled than in *comma*, anterior margin sharp Color pale yellow, a pair of broad, parallel, red stripes extending from the anterior margin of vertex across the scutellum and three pairs of oblique ones on the elytra , face dark Length, ♀ 5 mm , width, 1 75 mm

Vertex flat, but a trifle longer on middle than at eye, narrower than in *comma*, a transverse depression just before the sharp anterior margin , face in profile sharply angled with vertex, in one broad, slight curve to apex of clypeus , front moderately broad, its margin at base approaching the eye, gradually narrowing to the straight clypeus, but slightly transversely convex Pronotum strongly produced anteriorly between the eyes Elytra long and narrow, venation distinct towards apex, somewhat similar to *colon* in pattern, the outer anteapical cell closed, long and curved, central anteapical long, constricted, sometimes divided

Color · pale yellow above, a narrow line on anterior margin of vertex, a small spot either side of the tip, a curved mark on the costal margin of elytra behind the middle, a spot on second apical and the posterior margin of the central anteapical cell, black , two broad stripes parallel across vertex, pronotum and scutellum and three pairs on the elytra parallel with the claval suture, the inner pair continuous with those from the scutellum, bright red Face dark brown, shining

Genitalia female segment one-third longer than penultimate, with the lateral margin suddenly narrowed from near the base, then roundingly produced, the posterior margin with three faint lobes, produced part of nearly equal length and breadth. From under the emarginate side of the segment appears the acutely produced lateral angles of another membrane.

Habitat. Females from Texas and La. The male is, as yet, unknown.

ATHYSANUS OSBORNI VAN DUZEE (Plate 17, Fig. 4.)

Deltocephalus osborni Van D., Trans. Am. Ent. Soc. XIX p. 304 1892.

Bright straw yellow, sometimes tawny, four black spots back of the vertex margin. Size of *obsoletus*, but with a flatter vertex and more flaring elytra, venation Deltocephaloid, the central anteapical cell divided. Larger and lighter colored than *sexvittatus*. Length, ♀ 5.5 mm., ♂ 5 mm., width, 2 mm.

Vertex flat, a trifle rounded on the margin next to eye, obtusely, roundingly angled, over two-thirds the length of the pronotum. Face nearly flat, front broad above, approaching the eyes, rounding below to the straight clypeus, without a visible suture. Pronotum with the lateral margins very short, the humeral ones long and straight. Elytra long, narrow, flaring, two cross nervures between the sectors, three anteapical cells, the central one divided, often other cross nervures present, especially on the clavus.

Color straw yellow, washed with golden or tawny, vertex with four black spots just back of the anterior margin, the inner pair the larger, five pale lines on pronotum. Elytra with the nervures milk white, sometimes slightly and interruptedly fuscous-lined. Face pale, front with pale olive arcs, sutures around lorae, fuscous, femora twice annulate with fuscous, tibiae spotted.

Genitalia: female segment scarcely as long as the penultimate, lateral margins abruptly narrowed from near the base, exposing a rounding lobe of the membrane beneath, posterior margin of the narrowed segment roundingly emarginate, with a blunt median tooth, pygofers rather narrow; male valve very small, transverse, plates triangular, their tips acute, slightly longer than the ultimate segment.

Habitat. N. Y., Ind., Iowa, Neb. and Colorado. Only the long-winged form is known.

ATHYSANUS SIMPLARIUS NOV. NOM.

Deltocephalus simplex Van Duzee, Trans. Am. Ent. Soc. XIX p. 304 1892.

Stout, head large, form cylindrical. Venation and genitalia as in *osborni*. Greenish yellow, sometimes quite green on the elytra. Vertex with four large, black spots back of the anterior margin. Length, 4.75 mm., width, 1.75 mm.

Vertex large, sharply right-angled, as long as the pronotum, nearly twice as long on middle as against eye, front very broad above, almost touching the eyes, a little inflated, angularly narrowing from the antennae to the clypeus. Pronotum long, pushed forward between the eyes, posterior margin straight, lateral margin very short Elytra longer than abdomen in both sexes, almost parallel-margined; venation as in *osborni*, two cross nervures between the sectors and the central anteapical cell, divided

Color vertex straw yellow, slightly greenish cast, a pair of approximate, triangular spots just behind the apex and a large pair of oval ones inside and behind the ocelli. A line across the base of the apical spots would fall in front of the oval ones Scutellum pale yellow, pronotum and elytra pale green, the nervures lighter Front brownish, with pale arcs

Genitalia female segment a little longer than penultimate, suddenly narrowed from near the base, the lateral angles rounding, exposing the rounding angles of another membrane, posterior margin roundingly emarginate, with a triangular median tooth, male valve transverse, very small; plates together, semicircular, with their apices produced, half longer than the ultimate segment, their margins fringed with course hairs.

Habitat. N. Y., Md and N. J. Strikingly distinct from any other described species The characters of this and the two preceding species are very puzzling and contradictory, in some points they appear closely related, in others not at all They are not very closely related to the others in this group and are only placed here for convenience until their larval forms and life-histories are known.

The name *simplex* is preoccupied in this genus by *simplex* Sahlb, of Europe.

SUBGENUS STIRELLUS NOV

Head about as wide as pronotum, vertex narrow, rarely as wide as the long diameter of an eye, usually longer than its basal width. Front inflated, almost touching eyes above; vertex and front produced into a long, conical point, their margins indistinct. Elytra narrow, about as long as the abdomen; venation as in *Athysanus*, regular, ovipositor long and narrow, extending beyond the elytra except in *curtisii*.

Type of subgenus *A. bicolor* Van Duzee.

Key to the Subgenus

A Female ovipositor but little, if at all, exserted, rarely extending beyond elytra, face pale yellow with a fuscous "Y" resting on clypeus and its arms extending to the eyes, *curtisii* Fitch.

AA Female ovipositor long and narrow, extending beyond pygofers often one-fourth its length, usually extending beyond elytra, face without the "Y"

  B Face with a transverse, white band below eyes, occupying all the lower half except the apex of clypeus. Anterior margin of pronotum and scutellum, black, *bicolor* Van Duzee.

  BB. Face unicolorus or with scattered fuscous markings; pronotum unicolorous or with a row of submarginal spots

    C. Vertex right-angled, produced in front of eyes and conically pointed; four round, black spots in a square between the eyes, *obtutus* Van Duzee.

    CC Vertex obtusely rounding, extending but little in front of eyes, two large, black spots on anterior margin in female, male entirely dark, *mexicanus* n. sp.

ATHYSANUS CURTISII, FITCH.

Amblycephalus curtisii Fitch, Homop N Y State Cab p 61, 1851
Jassus nervatus Prov Nat Can IV, p 373 1872
Deltocephalus curtisii Prov Pet Faune Ent Can III p 278 1889
Athysanus curtisii Osb and Ball, Proc Ia Acad Sc IV p 221 1897—Proc Dav Acad Nat Sc VII, p 91, pl V, fig 1, 1898

Short and stout, greenish yellow, two large round black spots on vertex Elytra fuscous with the nervures green. Length 3 5mm, width 1.2mm

Vertex but little broader than a right angle, nearly twice as long on middle as against eye ; front very broad above, triangularly narrowing to the parallel clypeus Elytra broad and short, appendix small , venation simple, slightly variable, central anteapical cell short, straight-margined

Color vertex pale yellow with two large round black spots before the middle , pronotum with the anterior half shiny black, the posterior half greenish yellow, sometimes narrowly margined with fuscous behind Scutellum pale yellow, two fuscous points on the disc Elytra fuscous, the margins and all the nervures before the apical cells greenish yellow , face pale yellow a branching spot on the apex, the margin of front below the eyes and a median stripe down the clypeus fuscous, the two latter unite to form a Y-shaped figure Below fuscous

Genitalia *female segment half longer than penultimate*, the posterior margin slightly, roundingly emarginate either side a small, rounding median lobe , male valve roundingly triangular, as long as the ultimate segment , plates together equiloleralllv triangular, their apices acute, margins sparsely fringed with hair

Habitat Ontario Can., N. H , Vt , N Y , Pa , Ohio, Mich and Iowa The color pattern is quite constant and very distinct in our fauna, making this one of the easiest species to accurately determine

ATHYSANUS BICOLOR VAN DUZEE

Athysanus bicolor Van D Can Ent XXIV, p 114 1892
Deltocephalus virgulatus Uhl Proc Zoo Soc, Lon p 78 1895
Athysanus bicolor Osb and Ball Proc Ia Acad Sci IV, p 222 1897—Proc Dav Acad Nat Sc VII, p 91, pl V, fig 2 1898

Somewhat resembling *curtisii* the head narrower , female with two black spots on vertex and two stripes on elytra , male with the apex of vertex all black and the apex of elytra black with an oblique light dash Length, ♀ 3 5mm, ♂ 3mm ; width, 1mm

Vertex about as long as its basal width, slightly acutely conical, not quite twice as long on middle as against eye , front inflated above, but little narrowing to the long clypeus , pronotum strongly rounding in front with more than half of its length included within the long narrow eyes. Elytra rather short and broad, rounding behind with a very feeble appendix , venation obscured, similar to *curtisii*.

Color : vertex pale yellow, a pair of round black spots on anterior half, rarely confluent in female, confluent and covering anterior half of vertex in the male Pronotum greenish yellow, a black band on anterior third, another narrower band margining the pronotum behind and covering about half of the scutellum Elytra greenish yellow, the sutural margin, claval suture and apical margins narrowly fuscous in the female, a subhyaline area extends obliquely backwards from the costal margins In the male, and sometimes in the female also, these markings are all much broader and there is a fuscous patch in front of the subhyaline area connected internally with the apical margin by two oblique fuscous lines Face with upper half smoky in female, black in the male, the lower half pale yellow, sometimes a narrow black margin below in male Sometimes females are found marked like the males throughout

Genitalia female segment the length of preceding, posterior margin straight or very slightly emarginate, pygofers rather long, constricted behind, and much exceeded by the slender ovipositor, male valve equilaterally triangular, not quite as long as the ultimate segment and one-third as wide, plates but little longer than the valve, together nearly semicircular, their margins clothed with long hairs which are slightly exceeded by the light margined pygofers.

Habitat D. C, N J., Md, Va, N C., Fla., Ill., Iowa, Neb, Kans, Miss, Cuba, Hayti, St Vincent, Vera Cruz, Mex, and Para, Brazil This is a very widely distributed species and as is usually the case varies much in size and color in different localities Specimens are at hand from Hayti that average much smaller and paler than ours and on the other hand specimens from Vera Cruz are very large and most of the females have the black marking of the male type.

ATHYSANUS OBTUTUS VAN DUZEE

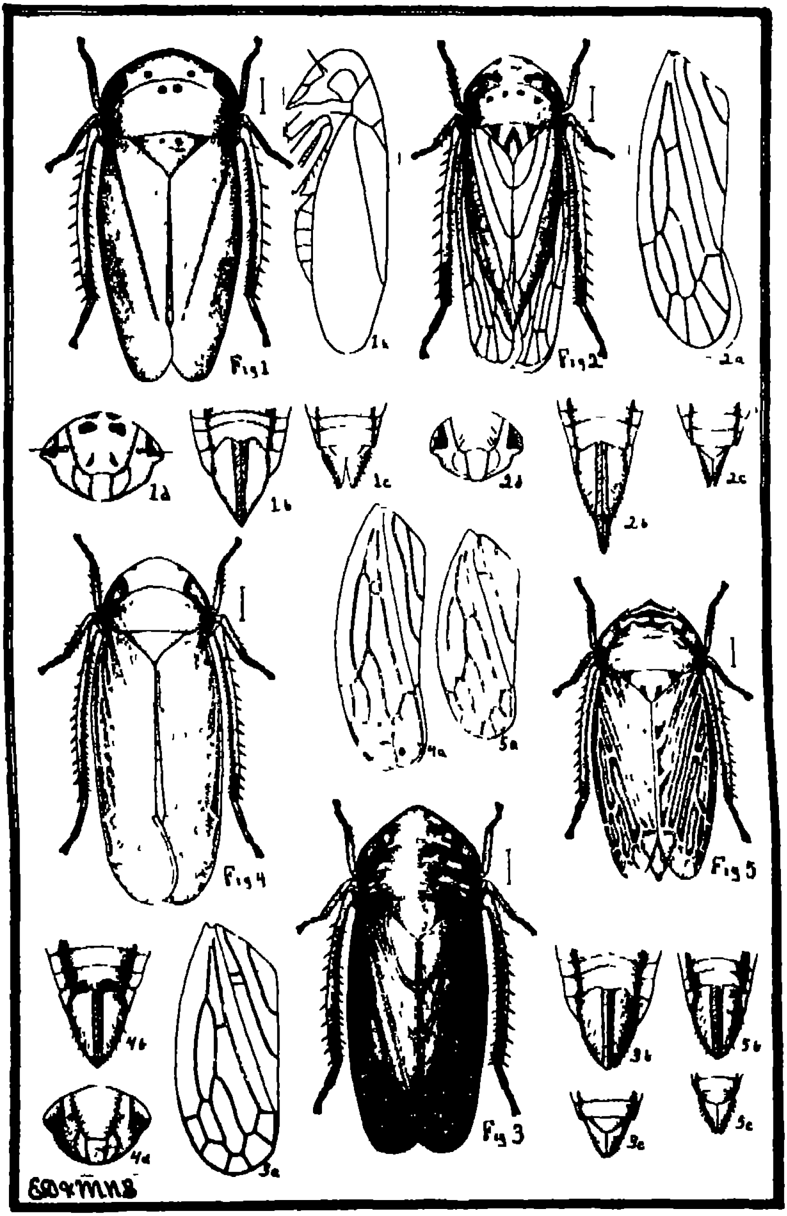
Athysanus obtutus Van Duzee Can Ent, XXIV, p 115 and 156, 1892
Athysanus obtutus Osb and Ball Proc Ia Acad Sc, IV p 222 Pl XXI, Fig 2 1897

Size and form of *bicolor*; testaceous, four black spots on vertex, a submarginal row on pronotum and the apical veins black. Length, ♀ 3 5 mm, ♂ 3 mm, width, 1 mm.

Vertex very slightly longer and narrower than in *bicolor*, distinctly longer than its basal width Head with the eyes inclosing more than half of the pronotum Elytra narrower than in *bicolor*, apex narrowly rounding, not reaching to the apex of the ovipositor in the female.

Color vertex pale testaceous, a pair of round spots on a line with the anterior margin of eye and another smaller pair behind them Pronotum testaceous, a row of irregular spots on the anterior submargin, scutellum with a pair of spots within the basal angles. Elytra testaceous, subhyaline towards the apex, with the nervures bounding the apical cells fuscous Face testaceous, the apex of clypeus fuscous, Sometimes in pale specimens the fuscous spots are nearly all wanting, while in dark ones the anterior pair on vertex are much enlarged and the face may be darkened above

OHIO NATURALIST. *Plate 16.*



OSBORN AND BALL ON ATHYSANUS.

Genitalia female segment very short, scarcely as long as the penultimate, posterior margin truncate or very slightly emarginate; pygofers as in *bicolor*, much exceeded by the oviduct, male valve small, equilaterally triangular, but little exceeded by the bluntly rounding, bristle-margined plates

Habitat. D. C., Md., Iowa, Kans, and Miss This species and the preceding very closely resemble each other in structural characters; *obtutus* however has a narrower vertex and face and more sharply angled elytra The color pattern is quite distinct and it is only very pale females of *bicolor* that could be confused with this species and even these may be separated by the lack of fuscous marking on the apical veinlets.

ATHYSANUS MEXICANUS N SP

Form of *obtutus* and *bicolor*, but with a blunter head and still longer ovipositor in the female Color, female greenish or brownish, vertex yellow with two black spots on the anterior margin, male all dusky brown or black Length, ♀ 3 75 mm, ♂ 2 75 mm, width, 1 mm

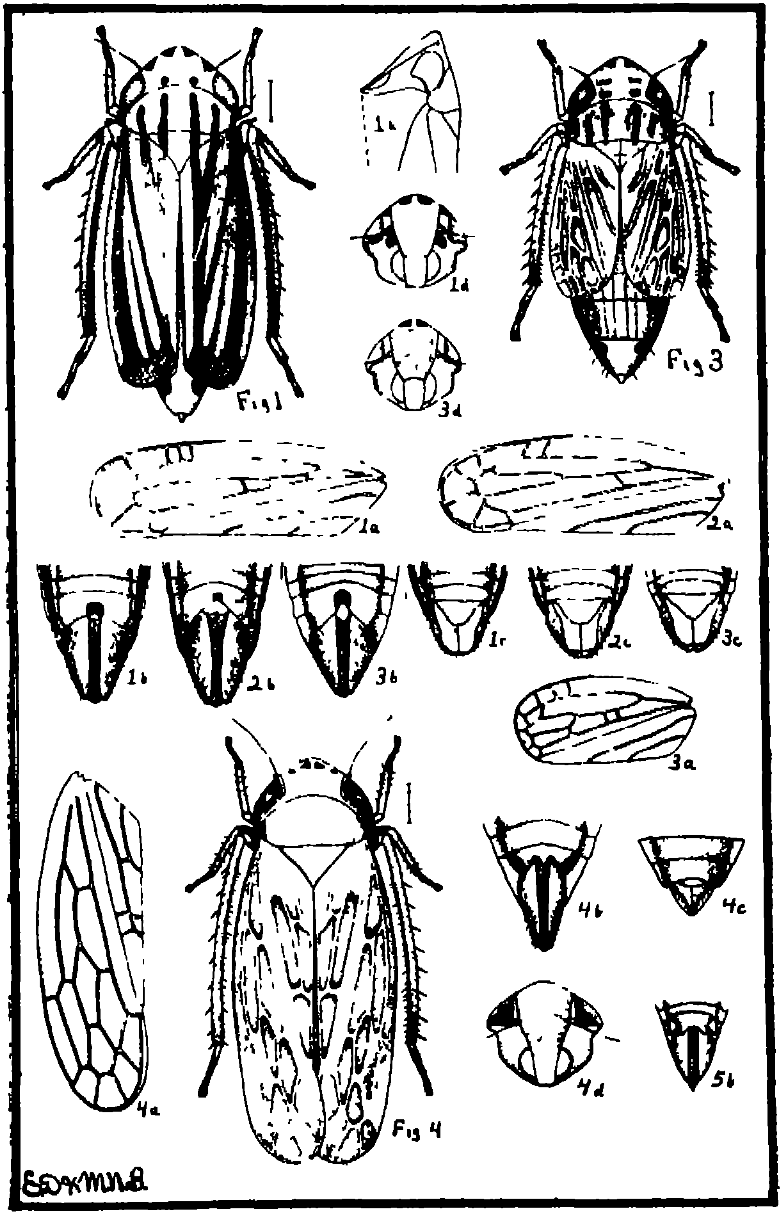
Vertex narrow, subquadrate, a trifle longer than its basal width, a fifth longer on middle than against eye, two-thirds as wide as the long diameter of eye, evenly rounding in front, the margin rounding to the face Front narrow and almost parallel-margined until just before the apex, where it rounds off to the long, straight-margined clypeus Elytra as in *bicolor*, not as long as the ovipositor in the female, the apical cells short.

Color female, vertex pale yellow, a pair of large, quadrate, black spots occupying all of the anterior margin except a median line and a narrower one next eye, usually a much smaller pair near the base behind these Pronotum greenish, or brownish with a few impressed fuscous spots in the middle of the anterior submargin Elytra greenish subhyaline, brownish subhyaline with greenish nervures, or entirely smoky brownish, ovipositor testaceous as seen from above Face pale yellow, arcs on front, sutures and a spot on middle of clypeus fuscous The upper pair of frontal arcs broad, spot-like, separated from each other by a line which is a continuation of the line on vertex, and from the spots on vertex by a line but little broader than the median one Male, vertex with the spots like female, but so large that they are only separated by narrow lines or are confluent and uniformly fuscous, darker than the eyes, pronotum brownish fuscous, shiny Elytra brownish or fuscous, the apical margin and rarely the claval areas milky. Front black with yellow margins and very short, yellow arcs, rest of face brownish, light on genae

Genitalia female segment about half longer than penultimate, margins parallel, ovipositor very long and narrow, longer than in *bicolor* or *obtutus*, exceeding the pygofers by more than the length of the segment; male valve right angled, the apex acute, plates roundingly triangular, the apex rounding, over twice as long as the valve, submargins with a few, stout, white spines

Described from numerous specimens from Orizaba, V. C. Mex. collected in Feb. 1892. (H. Osborn)

OHIO NATURALIST. *Plate 17.*



OSBORN AND BALL ON ATHYSANUS

SPECIES NOT INCLUDED

Athysanus acuminatus Bak

This species is only known by the single, faded, male type and while it without doubt belongs to the Subgenus *Conosanus* its character could not be made out with sufficient certainty to warrant including in the synopsis

Athysanus ornatus Gill

This species belongs to the genus *Driotura* O and B. of which *A gammaroides* is the type

Athysanus artemisiae G and B

Both the specific value and generic position of this species are still in doubt. It does not belong to any of the groups enumerated above and probably should not be included in the genus at all.

Athysanus litigiosus Ball

This species was only doubtfully referred here in the original description and does not fall readily into any of the above groups. When more material can be studied it will probably be possible to refer it to another genus

EXPLANATION OF PLATES

PLATE 16

Fig 1 *Athysanus frigidus* Ball
b, female, genitalia, *c* male genitalia, *d* face, *k* side view
Fig 2 *Athysanus exitiosus* Uhl
a elytron *b* female genitalia, *c* male genitalia *d* face
Fig 3 *Athysanus (Conosanus) plutonius* Uhl
a elytron *b* female, genitalia, *c* male genitalia
Fig 4 *Athysanus (Conosanus) symphoricarpae* Ball
a elytron, *b* female genitalia, *d* face
Fig 5 *Athysanus (Conosanus) arctostaphyli* Ball
a elytron, *b* female genitalia, *c* male genitalia

PLATE 17

Fig 1 *Athysanus (Commellus) comma* Van D
a elytron *b* female genitalia, *c* male, genitalia, *d* face, *k* profile
Fig 2 *a* elytron, *b* female genitalia, *c* male, genitalia of *Athysanus (Commellus) colon* Osb and Ball
Fig 3 *Athysanus (Commellus) sexvittatus* Van D
a elytron *b* female, genitalia *c* male, genitalia, *d* face
Fig 4 *Athysanus (Commellus) osborni* Van D
a elytron, *b* female, genitalia, *c* male, genitalia, *d* face
Fig 5 *b* female genitalia of *Athysanus (Conosanus) dentatus* Osb and Ball

The figures have been drawn by Mr Ball and finished in ink by Mrs Ball

A POSSIBLE CAUSE OF OSARS.

GEO H COLTON

On the 20th of April, 1901, there fell in north-eastern Ohio an unusually heavy snow covering the ground to a depth of from twenty inches on a level to seven feet in drifts The snow came very rapidly and went very rapidly During the period of rapid melting strong currents of water flowed beneath the snow which in some cases carried along much sediment It was my good fortune to observe a point near the borders of a gently sloping plowed field where one of these streams, becoming clogged, rose to the surface and flowed for a short distance over the dense snow, spreading the abundant sediment, which it carried in a sinuous belt along its channel After a time the stream deserted this surface channel and found a new one beneath the snow. As the snow melted the belt of sediment which had accumulated in the channel on its surface gradually settled, and when the snow had disappeared it rested upon the turf that bordered the plowed field as a miniature osar

While it is rightly assumed that the surface of the glacial ice-sheet was for the most part clean and free from earthy deposits, yet near its southern margin there may have been much sediment on its surface Streams of great force and volume, heavily laden with glacial detritus, flowed beneath the ice, and it is possible, and even probable, that the shifting of the melting ice, undermined by the flowing waters, and the displacement of the loose material of the deep moraine as the ice reacted upon it, would occasionally clog the channels of these streams and compel them to find new ones In most cases the new courses would be beneath the ice as before, but it is reasonable to assume that sometimes the obstructed stream, like the rill in the snow-field described above, would rise through some crevasse and flow for a time over the surface of the ice Such a stream would have its rapids swept clean of sediment, and its stretches of deep and sluggish water in which would accumulate belts of sand and gravel. When the stream deserted its ice channel, as it surely would in time, these sinuous belts of sediment would lie almost undisturbed upon the surface of the glacier, and they would be left finally, when the ice had disappeared, as ridges over the surface of the land, forming what glacialists call osars, or serpent kames Indeed, such surface accumulations would be far less likely to be disturbed and obliterated by subsequent changes than would those gravel belts which, in spite of the many difficulties involved, it has been assumed, might be formed beneath the ice by sub-glacial streams.

Hiram College, Hiram, O.

SMUT INFECTION EXPERIMENTS

W A KELLERMAN AND O F JENNINGS

Experiments were undertaken during the summer of 1901 to test the comparative susceptibility of maize (dent corn pop corn and sweet corn) and sorghum (Saccharine sorghum Kaffir corn and broom corn) to the same species of smut found on different hosts Both the sorghum seed smut (Cintractia sorghi) and the head smut (Cintractia reiliana) were used

Three rows each of dent corn pop corn sweet corn Kaffir corn sorghum and broom corn were planted One row of each set of three was planted with untreated seed as a check row Another row of each set was planted with seed rolled wet in sorghum head smut (Cintractia reiliana) obtained from sorghum The remaining row of each set was planted with seed rolled in the same species of smut obtained from maize

In the same manner Kaffir corn sorghum and broom corn were used being treated with the sorghum head smut (Cintractia sorghi) grown on the two hosts sorghum and broom corn

Thorough precautions were taken in treating the seed and interesting results were expected Unfortunately severe drouth and abundant chinch bugs blasted hopes and experiments alike Only one specimen of Cintractia reiliana was obtained namely on pop corn So few stalks infected with Cintractia sorghi were obtained that no conclusions can be drawn Experiments along these lines are now being carried on in the botanical greenhouse from which some satisfactory results are being obtained and which will be reported later

A few stalks of sorghum artificially infected two to three years ago and still growing continuously produce infected panicles

An illustration of one of the specimens planted January 1st 1899 is here given This illustrates the fact that infection takes place through the seed first shown in 1891 * It also demonstrates that the mycelium permeating throughout the entire plant is perennial or at least is coexistent in duration with the host the latter grown as an annual in our climate but when protected as has been the greenhouse specimen it may continue to live a long while

The other experiments which are enumerated below relate to corn smut (Ustilago zeae) the primary object being to determine the effect of mutilation of the host upon the prevalency of the smut Work of this kind has been reported by Hitchcock † Clinton‡ and others

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* Kellerman W A Bullet Kas Exp Sta N 23

† Bot Gaz 28 429 899

‡ Ill Exp Sta Bul 57 March 1800

The corn selected for the experiment was growing on the Ohio State University farm and was in good healthy condition At the beginning of the experiment July 30 it averaged about six feet in height and was partly in tassel

In order to keep the different parts of the experiment as distinctly separate as possible every twentieth row was chosen and the second row west of this was taken as a check row

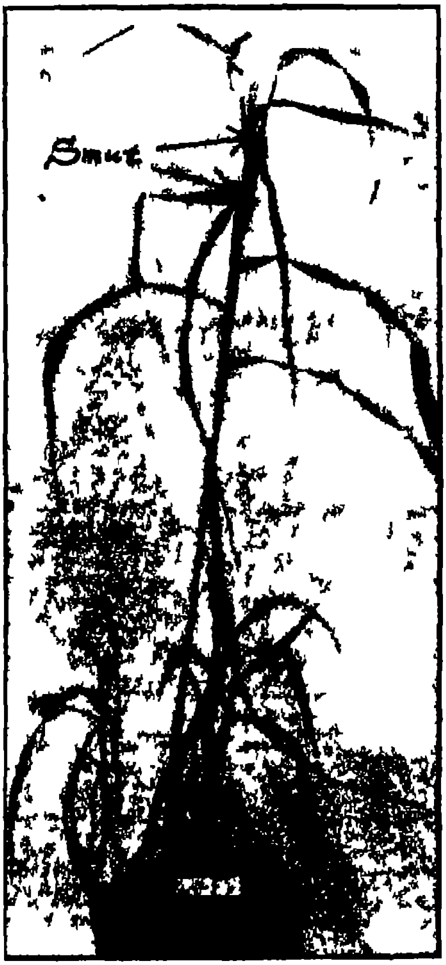

Fig Sorghum 3 years old artificially infected through the seed

Row A 1

Each stalk in this row (972 stalks in all) was mutilated on east side but at no given height by being scraped with a piece of broken hack saw blade The work was done in late afternoon between 6 and 8 P M A fairly heavy dew followed but no rain for several days

Results 15 per cent of the stalks were smutted while the corresponding check row showed but 3 7 per cent affected The percentage of smut on the ear as compared to the total smut on the whole plant showed that of the total smut on the mutilated row only 29 2 per cent was on the ear while the check row on the other hand showed 32 9 per cent The difference is probably due to the fact that the ears were not developed sufficiently to be affected by the mutilation i e the stalks were mutilated while the ears were not The position of the smut balls in relation to the wounds was quite significant 34 2 per cent of the smut balls were either *on* or *within six inches* of the wound but within the next six inches above and below the wound only 1, 6 per cent were to be found

Row No 2

Each stalk (842 in all) was mutilated as in No 1 and then smut spores immediately brushed on or painted over the wound The smut used had been kept dry in a tight box since the fall of 1900 The work was done after 5 P M and was followed by a good dew but no rain soon

Results 11 5 per cent of these stalks were smutted against but 8 5 per cent in the check The relative position of the smut in this part of the experiment was however quite significant 53 8 per cent of the diseased stalks were infected within six inches or upon the wound while in the next six inches above and below the wound only 17 5 per cent of the bolls were to be found

Row 3

Each of these 806 stalks was painted at some place with spores as in No 2 but none were mutilated This was done in early evening and although followed by no dew a fine mist fell the next morning

Results 10 4 per cent of the stalks were smutted against a check of 8 6 per cent Also the percentage of smutted ears to total diseased stalk was again significant in the check row 20 9 per cent while in the infected row it was but 16 6 per cent

Row No 4

This row was detasseled during the partly cloudy forenoon of August 3

Results 11 5 per cent of the stalks were diseased against a check of 9 5 per cent The percentage of the total diseased stalks having the ear as the affected part was 22 3 per cent in this row and 28 6 per cent in the check row

Stated very briefly the results are in accord with those obtained at the Indiana and Illinois Experiment Stations in recent years At the stage of growth when the tassels are just appearing detasseling mutilation of the stalks lower down and the application of spores without wounding the stalk all cause an increase of smut and mutilation and the application of spores to the wound thus made results in a still larger per cent of smut

Following is a tabulation of the results obtained

Number of row	1	x	2	x	3	x	4	x
Total number of stalks	972	1,026	842	841	806	777	737	884
Percentage of stalks smutted,	15	9.7	11.5	8.5	10.4	8.6	11.5	9.5
Percentage of diseased stalks having diseased ears	29.2	32.6	18.6	18.1	16.6	20.9	22.3	28.6
Percentage of smut above ear,	7.5	8	8.2	8.3	8.3	7.5	2.3	7.1
Percentage of smut below ear,	63.3	60	73.2	73.6	75	71.6	75.3	64.3
Percentage of smut *on* or within six inches of wound ...	34.2		59.8					
Percentage of smut over six but less than twelve inches from wound	13.6		17.5					

x check row

TRAILING AND CREEPING PLANTS OF OHIO.

ALICE DUFOUR

Lines of demarcation between creeping forms and climbing forms and also between creeping forms and those that are nearly decumbent do not exist. Creeping plants do not include those with special runners like the strawberry, or those with deep underground root-stalks like some lilies, or those forming mats like some of the spurges. Under the term creeping plants are included such forms as are prostrate and spread as do the melons, or such as spread by the stems striking root as does the wintergreen.

There are about 42 creepers in Ohio. Of these 8 are annuals, 34 are perennials, 9 woody, 33 herbaceous, 26 native, and 16 introduced. These are

Ranunculus repens, herbaceous perennial from Europe
Rubus hispidus,
    villosus, woody plants
Dalibarda repens, herbaceous perennial
Potentilla canadensis, herbaceous perennial.
Trifolium repens, herbaceous perennial
Lespedeza repens,
    procumbens, herbaceous perennials
Lathyrus maritimus,
    palustris,
    myrtifolius, herbaceous perennials
Vicia hirsuta, annual from Europe

Oxalis corniculata, introduced herbaceous perennial.
Hydrocotyle umbellata,
americana, herbaceous perennials
Epigaea repens, woody
Galtheria procumbens, woody
Arctostaphylos uva-ursi, woody
Chiogenes, hispidula, woody
Oxycoccus oxycoccus,
macrocarpus, woody plants
Lysimachia nummularia, herbaceous perennial
Vinca minor, herbaceous perennial, Europe
Convolvulus arvensis, herbaceous perennial, Europe
repens, herbaceous perennial
Ajuga reptans, herbaceous perennial, Europe and Asia
Glechoma hederacea, herbaceous perennial, Europe
Kickxia spuria, annual from Europe
Gratiola aurea, herbaceous perennial.
Veronica agrestis, annual from Europe
officinalis,
serpyllifolia, herbaceous perennials
Cymbalaria cymbalaria, herbaceous perennial, Europe
Mitchella repens, herbaceous perennial
Euonymus obovatus, woody
Myosotus palustris, herbaceous perennial, Europe
Lippia lanceolata, herbaceous perennial
Cucurbita pepo,
maxima, annuals, introduced
Citrullus citrullus, annual, Asia
Cucumis melo,
sativus, annuals, Asia

New York City

CORRECTED DESCRIPTION OF PHYLLOSTICTA ALCIDES

Through some unaccountable mistake the description of this species was not given correctly on p. 223 of the preceding No. of the OHIO NATURALIST. It should have been as follows:

PHYLLOSTICTA ALCIDES Ell. & Kellerm.—Spots cinereous, epiphyllous, subindefinite, 2-4 mm. Perithecia scattered on the spots, punctiform, 100-120 μ diam., raising and puncturing the epidermis, soon perforated above. Sporules short-fusoid or oblong, yellowish, 2—3-nucleate, 7-15 (mostly 7-10) x 3–3½ μ. Found associated with Leptosphaeria alcides Sacc., of which it is apparently the spermogonial stage.

MEETING OF THE BIOLOGICAL CLUB.

ORTON HALL, March 3, 1902.

The Club was called to order by the President and the minutes of the previous meeting were read and approved. The paper of the evening was by Mr. Miller, who spoke of the work that is being done by the Division of Soil Physics, U. S. Department of Agriculture.

F. J. TYLER, *Secretary.*

The Ohio Naturalist,

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GALLS AND INSECTS PRODUCING THEM.

MELVILLE THURSTON COOK.

PART I THE MORPHOLOGY OF LEAF GALLS.

The purpose of this study was to contribute to the knowledge of cellular activity of the plant under peculiar animal stimulus; to compare the effects of the two sets of insect organs, mouth parts and ovipositors, and to throw additional light on the classification. The statements made in this paper are based on a large number of collections The collection of stem galls was too incomplete to draw conclusions and is therefore reserved for a future paper. No attempt was made to follow the development of the galls but rather to make a comparison of the structure of the various forms of galls

My paper was practically complete before I received the papers of H Fockeu. After receiving his paper I reviewed my own to determine wherein my results agreed with or varied from his conclusions Experiments such as are described by H. Fockeu to ascertain the cause of the gall formation were not attempted.

Fockeu's studies were grouped according to the plants affected; my own studies were grouped with reference to the insect producing the galls.

METHODS.

For the killing and fixing, several fluids were used, but the most successful were Chromo-acetic and Picric-alcohol. A number of different stains were used, but Delafields-Haemotoxylon proved very satisfactory for most work.

For the drawings a Bausch & Lomb microscope and camera lucida were used; for the normal leaf, a 1-inch ocular and a ⅛-inch objective, and for the galls a 1-inch ocular and a ⅔-inch objective. Since it was unnecessary to make drawings of the entire galls, drawings were made from one or more parts to show the characteristic structure, and this part is indicated on the small diagrammatic drawings. Since the galls were so variable in size, it was practically impossible to make the diagrammatic drawings on a definite scale.

GENERAL CLASSIFICATION.

As a matter of convenience the following temporary classification, based on location of the galls was adopted for this and other papers now in preparation A. Stem galls, B Leaf galls, C. Bud galls, *a* Terminal buds, *b.* Lateral buds; D. Root galls.

Leaf galls may in many cases be classed as bud galls if we consider that the egg in some orders of insects is deposited while the leaf is in the bud, but in the above classification the term applies to the developed gall, and the 'bud gall' applies to a distortion of the entire bud

1. THE NORMAL LEAF STRUCTURE AND ITS VARIATIONS The normal leaf structure may be said to consist of a single layer of epidermis on the upper and lower surfaces of the leaf, next to the upper epidermis is the usually single layer of palisade or columnar cells, placed with their long axis at right angles to the surface of the leaf, between the palisade cells and the lower epidermis is the mesophyll, made up of many layers of irregular cells, between which are the large air spaces connected with the outside by the stomata in the lower epidermis, running through the leaf are the fibro-vascular bundles noticable to the naked eye as the venation.

Although the above may be said to be a description of a typical leaf, it must be kept in mind that leaves are subject to great variation and this must be taken into consideration in a discussion of the variation of the gall structure from the normal leaf The structure of the gall must be compared with the structure of the normal leaf of the plant on which the gall is found, not with the typical leaf.

A brief study of the normal leaves of the plant will serve to emphasize the preceding points *Hicoria ovata* (Mill) Britton (Fig 1), *Ulmus americana* L (Fig 4), and *Tilia americana* L (Fig. 6) may be considered as typical and yet in themselves show minor differences In *Vitis vulpina* L (Fig 3) the palisade is not so pronounced as in the preceding and the mesophyll is more compact. In *Quercus alba* L (Fig. 7) and in *Acer saccharinum* L. (Fig. 5) the palisade is typical, but the mesophyll is very compact In *Salix cordata* Muhl. (Fig. 2) the mesophyll while distinct from the palisade has assumed palisade characters.

The differences in structure between the normal leaves of *Hicoria ovata* (Fig. 1) and *Salix cordata* (Fig. 2), members of two related families, are as great as those differences frequently found between a normal leaf and the galls occurring upon it, *e. g.*, H. ovata (Fig. 1) and the simpler Phylloxera galls (Figs. 16–20)

2 PHYTOPTUS GALLS. This discussion is based not only on the four galls described below, but from observations of several others. However, the following will illustrate all the points observed

The Phytoptus galls are small and may extend on either or both sides of the leaf. The outer surface of the galls show the normal epidermis and below this cells which are not palisade but which are elongated with the surface of the gall, *i. e*, the direction of growth (Figs 8, 9, 11). Projecting into the gall cavity are masses of irregular shaped cells (Figs 8-11). In young galls these cells show a nucleus, take the stain readily and show indications of maturity (Figs. 9, 11) Trichomes are always found extending from the walls of the cavity (Figs. 8-11) of young galls, but disappear as the galls approach maturity. In these galls we evidently have a repeated puncturing of cells by the animal and an increased activity on the part of the plant in its effort to recover from the wound, the wound never being sufficient to cause the death of that part of the plant

My results on the Phytoptus galls agree with those of H Fockeu, except in minor points

3 THE APHIDIDAE GALLS. In this family we find the simplest form of galls discussed in this paper, of which *Schizoneura americana* Riley (Fig 12) may be taken as a type. In fact it is a mere curling of the leaf and not what is usually considered a gall According to E Perris it would be classed as a galloide. However, the structure is very similar to that of a typical gall of this family of insects and I see no reason why it should not be considered a true gall

When compared with the normal leaf of U americana L (Fig 4) the palisade cells are observed to have lost their identity and to have assumed mesophyll characters and the mesophyll has become more compact, both distortions being characteristic of true galls of this family (Figs 13-21).

In *Colopha ulmicola* Fitch (Fig 13 a b) and *Pemphigus ulmifusus* (Walsh.) Oestlund (Fig 14 a. b) both of which are also characteristic galls on the elm, we find practically the same structure as in S americana In both the outer (upper) epidermis is much elongated, the same being true of the inner (lower) epidermis of C ulmicola, but not in P. ulmi-fusus. The identity of the palisade cells is entirely lost, the cells now being slightly elongated parallel to the surface of the gall. The mesophyll cells are more compact than in S americana and far more compact than in a normal leaf (Fig. 4).

A granular, dark brown, often black substance in the cells was characteristic of the elm and other galls of this group. This was probably tannin, and its presence seemed to depend on the host plant rather than on an insect producing the gall.

The *Hormaphis hamamelis* Fitch (Fig. 15 a. b.) on the Hamamelis virginiana L. showed the same general structure as the preceding galls of this order, except that the epidermal cells were not so much elongated and in the inner (lower) epidermis the cells were much smaller and showed thicker walls, and the dark granular contents of certain cells was restricted to layers near the outer (upper) surface.

The Phylloxera galls show considerable variation from each other. *P. c. avenae* Fitch, *P. c. fallax* Riley, and *P. c. globuli* Walsh. (Figs 16-18), of Hicoria ovata may be taken as forming a rather well defined group and as showing greatest resemblance to the preceding galls of this family. When compared with the normal leaf (Fig. 1) of the host, H. ovata, they show a reduction in size of the epidermal cells, the palisade cells losing their identity, and the mesophyll becoming very compact. Very little of the dark cell contents characteristic of the preceding galls of this family was present, the greatest amount being formed in P. c. avenae (Fig. 16) where it is restricted to the epidermis and to the cells just below it. The cells are even less elongated and more irregular than in the preceding galls In general it may be said that in this group the largest cells are midway between the two layers of the epidermis and gradually decrease as we approach the surfaces. This is especially true of P. c. globuli (Fig. 18).

P c. spinosa Shimer (Fig. 19 a. b.) is a very large gall occurring on leaf, petiole, or young, green twigs of Hicoria ovata and shows considerable variation from the preceding Two zones are very distinct, the outer is composed of large cells which do not take the stain readily, the inner zone of small cells stained very readily and show great activity. This may, however, have been due to the fact that my specimens of this gall were much younger than of the preceding Phylloxera galls A long tube for the exit of the insect is formed.

In *P. c. depressa* Shimer (Fig 20 a. b) of H. ovata and *P. vastatrix* Planchon (Fig. 21 a b.) of Vitis vulpina we have still other and more marked variation. The cavity is much smaller, the walls much thicker than in the preceding, and a long tube, especially in P. c. depressa is formed for the exit of the insect. In both cases the size of the epidermal cells is much reduced when compared with the normal (Fig 1, 3), the palisade cells have not so completely lost their identity as in the preceding and there appears to be a general elongation of the cells with their long axis perpendicular and not parallel to the surface of the gall A small but definite, deeply staining zone of cells surrounds the cavity in P. c. depressa. Many cells show dark contents similar to that found in the galls on Ulmus and Hamamelis (Fig. 12-15)

P. vastatrix shows a comparatively large number of trichomes, especially near the opening, but this is probably a characteristic of the host plant rather than of the gall.

The presence of the two well defined zones, which may be considered protective and nutritive in P. c. spinosa and P. c. depressa, show a very marked resemblance to the Cynipidae galls (Figs. 25-30).

It may be that all young galls show this arrangement into two or three zones.

In P. c. depressa (Fig 20) and in P. vastatrix (Fig 21) the small larval chamber and general arrangement of the cells is very similar to the leaf galls produced by Cecidomyia verrucola (Fig. 2.)

4 THE CECIDOMYIA GALLS This group of galls shows considerable variation *C. gleditsiae* O S (Fig. 22 a. b c. d) of Gleditschia triacanthos may be taken as a type of one of the simplest. In this the margins of the leaflets are in contact so as to form a more or less sperical body. To the naked eye it presents no other distortion. Under the microscope the cells show an elongation from midrib to margin, *i. e.*, parallel to the surface of the gall except near the margin, where they are irregular

C. quercus-pilulae Walsh (Fig 23 a. b.) shows a more highly developed gall structure. The epidermal layers are made up of smaller cells than the normal leaf The mesophyll has lost its identity and assumed the palisade structure, the long axis being perpendicular to the surface of the gall The larval chamber is large and rather irregular and indefinite, and resembles a large inter-cellular space.

C verrucola O. S. (Fig 24 a b) on Tilia americana shows a much higher complexity than either of the preceding. The epidermis is made up of small cubical cells The differentiation into palisade and mesophyll is entirely lost, the cells are very irregular, but show a tendency to elongation at right angles to the surface of the gall The larval chamber is small and well defined

C q -pilulae (Fig 23) and C verrucola (Fig 24), especially the latter show a striking resemblance to the more highly developed Phylloxera galls such as P c.-depressa (Fig. 20) and P. vastatrix (Fig 21)

5 THE CYNIPIDAE GALLS This family presents the most striking series of evolutionary development of any family studied and is also apparently the most highly developed.

The general characters presented by these galls are small, cubical epidermal cells ; loss of differentiation between palisade and mesophyll cells, all having assumed an irregular character , a differentiation into two well defined zones of cells, the outer made up of large, non-staining cells, the inner made up of smaller, deeply staining cells and surrounding the larval chamber.

Fockeu divides these into four zones, which he designates as follows. 1 Epidermis ; 2 Parenchyma , 3. Protective , 4 Nutritive ("Masse alimentaire") These four zones may be easily traced in most of our American forms, but in some they show very indistinctly

Neuroterus irregularis O. S. (Fig. 25 a. b.) is a small, fleshy, solid, irregular gall projecting from both sides of the leaf. It is covered with dense growth of trichomes and contains several larval chambers. In structure it does not correspond to the preceding description, as well as the galls described in the latter part of this paper. The parenchyma is divided into two very distinct zones, the larval chamber occupying the lower part of the inner zone The inner zone cells have much thinner walls than those of the outer cells. Surrounding the larval chamber is a zone of cells which stain very deeply and probably furnish nourishment to the larva. The epidermal cells are small.

Callirhytis tumifica O. S. (Fig 26 a b.) is a small, fleshy, solid gall projecting on both sides of the leaf and resembles N. irregularis (Fig. 25), except that it is a little larger, does not have so many larval chambers and is smooth. It presents the simplest characters studied, showing the characteristic small, more or less cubical epithelial cells, the lack of differentiation into palisade and mesophyll, and the two zones. The outer zone is very thick and is in contact with the inner zone The inner zone is narrow and lies near the large larval chamber At the point of union of the two zones the cells are very small The outer zone can be readily subdivided into epidermis and parenchyma, but the inner zone cannot be subdivided into two sub-zones unless we consider the layer of small cells as the protective sub-zone. However, this sub-zone of small cells does not possess the sclerenchyma character described by Fockeu for the Cynipidae galls

Holcaspis centricola O S. (Fig. 27 a b c) is a large, spherical gall projecting both above and below the leaf In this we have the two zones, but each retaining the characters previously described, the cells of the inner zone, however, being smaller than in C. tumifica The epidermal cells have thicker walls than in any other Cynipidae gall examined. The two zones are connected by fibro-vascular bundles In this the four zones of Fockeu are quite well defined The outer zone forming the very distinct epidermis and parenchyma, the inner zone showing a fairly well defined protective and nutritive part.

Amphibolips inanis O S (Fig. 28 a. b) shows a very striking resemblance to H centricola (Fig. 27), except that it is much larger The epidermal cells do not have such thick walls as in H. centricola and are much longer and narrower The inner zone is readily subdivided into the protective and nutritive sub-zones described by Fockeu. The inner or nutritive sub-zone is made up of thin-walled cells with prominent nuclei, the outer or protective sub-zone of sclerenchyma cells. The connection between the two main zones is by means of fibro-vascular bundles, the same as in H. centricola

Dryophanta palustris O S. (Fig. 29 a. b. c.) presents a condition very similar to the two preceding galls, H. centricola (Fig. 27) and A. inanis (Fig. 28), except that the fibro-vascular bundle connection between the two zones is not present ; the inner zone containing the larva forms a sphere which is free in the large chamber formed by the outer zone.

The inner zone shows a marked resemblance to H. centricola (Fig. 27). The subdivision into protective and nutritive parts in my specimens was not like the characteristic zones described by Fockeu; the inner cells were apparently much thicker walled and more indefinite. However, I believe that younger galls would have shown the typical characters. The outer zone is thicker than in either H. centricola (Fig. 27) or A. inanis (Fig. 28), but not so thick as in C. tumifica (Fig. 26). It can be readily subdivided into epidermis and parenchyma and it also shows a fairly well defined endodermis, and in that respect differs from either H. centricola or A. inanis.

Callirhytis papillatus O. S. (Fig. 30 a. b. c.), which is similar to the preceding Cynipidae galls, but shows considerable variation from them. It is smaller than any of the preceding and is embedded in the leaf very similar to C. tumifica (Fig. 26). The two zones are separated, the outer being similar to A. inanis (Fig. 28), the inner zone surrounding two or three larval chambers instead of one. Next to the larva the cells are very large and thin and may be considered nutritive, outside these we have well defined parenchyma or protective cells, and outside these we have two or three layers of cells well filled with protoplasm. The connection between the outer and inner zones is by single elongated cells, which are very rich in protoplasm.

The evolutionary development of the preceding Cynipidae galls is evident. All show the two well defined zones, the outer non-staining made up of epidermis and parenchyma and the inner which takes the stain readily and is made up of two subdivisions, protective (or sclerenchyma cells) and nutritive (or parenchyma cells). In C. tumifica (Fig. 26) we have the two zones in contact, in H. centricola (Fig. 27) and in A. inanis (Fig. 28) we have a separation of the two zones which are now connected by fibro-vascular bundles, in C. papillatus (Fig. 30) the two zones are connected by long, undivided cells; in D. palustris (Fig. 29) we have a complete separation of the two zones.

With the exception of N. irregularis (Fig. 25) and C. tumifica (Fig. 26) they all show a division into four zones as described by Fockeu. However, Fockeu does not describe a separation between the parenchyma and protective zones which is so characteristic of some of our American galls. I am inclined to consider our American Cynipidae galls as having reached a higher stage of development than the European forms.

The larva in all species evidently draws its nourishment directly from the inner zone. In H. centricola (Fig. 27) and A. inanis (Fig. 28) the inner zone evidently gets its nourishment through the fibro-vascular bundles; in C. papillatus (Fig. 30) the supply of nourishment comes through the long filamentous cells; in D. palustris (Fig. 29) it is probable that the larva is far advanced in its development before the separation of the two zones and the nourishment remaining in the inner zone at the time of the separation is sufficient to complete its development

Adler and Stratton after describing similar modifications in the European Cynipidae galls, say: "Besides these histological differences, the outward characters are also of varying complexity, each infinitesimal improvement, which has been of service as a protection against parasites, or has been successful in securing natural conditions favorable to the life and growth of the larva, has been preserved, and has formed the starting point of further beneficial variation It is always that larva which has been able to induce successful morphological abnormalition, which is reproduced to continue the race; the unsuccessful perish. The ruling force is natural selection, it is impossible that intelligence or memory can be of any use in guiding the Cynipidae, no Cynips ever sees its young, and none ever pricks a bud the second season, or lives to know the results that follow the act Natural selection alone has preserved an impulse which is released by seasonally recurring feelings, sights, or smells,* and by the simultaneus ripening of the eggs within the fly These set the whole physiological apparatus in motion, and secure the insertion of eggs at the right time and in the right place The number of eggs is instinctively proportionate to the space suitable for oviposition, to the size of the fully grown galls, and to the food supplies available for their nutrition."

CONCLUSIONS

1. Galls may be classified into two general groups, viz., those produced by mouth parts and those produced by oviposition. Those produced by oviposition may be considered the more highly developed.

2. The family Cynipidae shows by far the highest development of gall structures.

3 The morphological character of the gall depends upon the genus of the insect producing it rather than upon the plant on which it is produced; *i e*, galls produced by insects of a particular genus show great similarity of structure even though on plants widely separated; while galls on a particular genus of plants and produced by insects of different genera show great differences This seems to indicate that the stimulus of a particular genus of insect is given to a particular part of the host plant or is of a peculiar kind, characteristic of that genus However, if the stimulus of two different genera of insects be applied to the same part of the plant the results may be similar. (See Part II.)

4. Within each family we find certain morphological resemblances, *e. g*, Aphididae.

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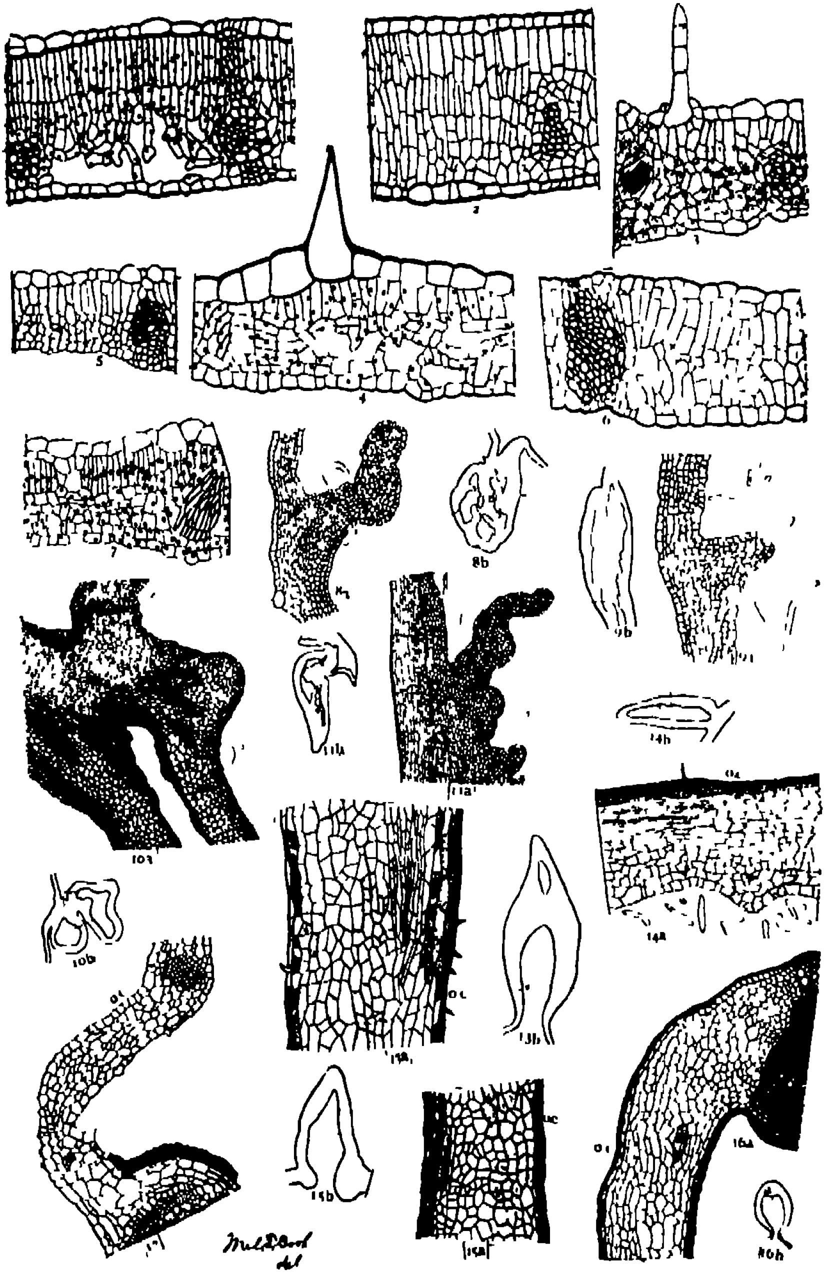
*Weismann, Essays on Heredity, Vol I, p 95



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5. The families show parallel lines of development from a low form of gall structure up to a high form *e. g*, Aphididae and Cynipidae

6. I am inclined to believe that the modification of the plant tissue is purely mechanical The loss of differentiation between palisade and mesophyll and the closing up of the intercellular spaces would be a natural result of rapid cell division. The elongation of cells in certain directions would be a natural result of mechanical tension arising from rapid growth. In the family Aphididae where the gall is primarily a folding of the leaf the elongation of the cells is parallel with the surface of the gall. In those galls where the formation is a thickening of the leaf the long axis of the cells is perpendicular to surface of the formation

7 The presence of at least two zones, of which the inner may be considered nutritive, is very common.

8 The formation of the gall is probably an effort on the part of the plant to protect itself from an injury which is not sufficient to cause death Both Adler and Fockeu consider that after the first stages of formation the gall becomes an independent organism growing upon the host plant

9 Trichomes are far more prominent in galls produced by mouth parts than in those produced by oviposition

10. It appears from these studies that the histological characters of the gall will prove very important in determining the characters of the species

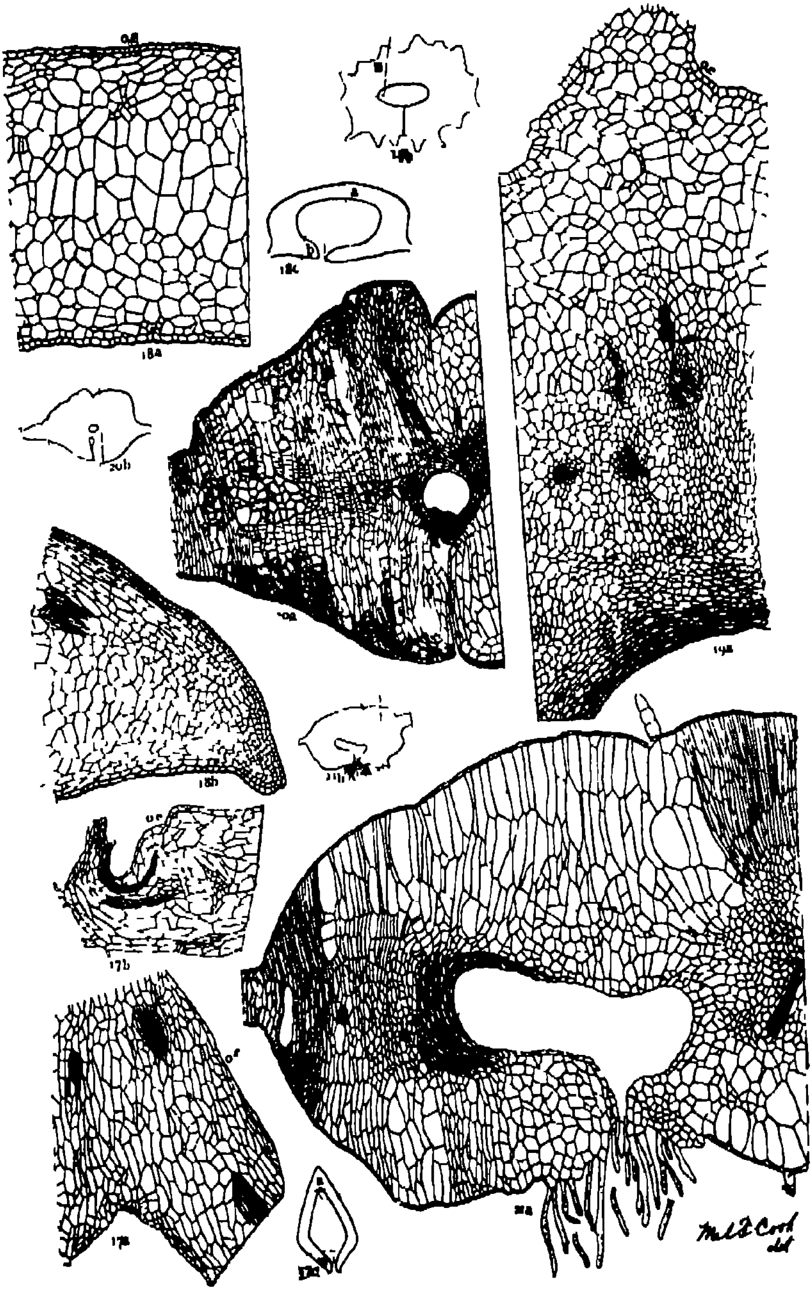
PART II APICAL BUD GALLS

In my third conclusion in the preceding paper I have expressed a belief that galls produced by the same genus of insects show a decided resemblance even though produced on widely different plants. Furthermore, this similarity seemed to be due to the particular part of the host plant to which the stimulus was applied.

The following study of the apical bud galls seem to indicate that when corresponding parts of different plants are stimulated by insects of different genera that the galls produced have characters in common

The gall produced by *Cecidomyia solidaginis* Lw (Fig 31) is merely a large bunch of leaves at the end of the stem of Solidago The cone-shaped gall of *Cecidomyia salicis-strobiloides* O S. (Fig 32) at the tip of the twigs of Salix is a bunch of leaves reduced in size and so compactly arranged as to produce the peculiar cone effect A further examination of these two galls shows that the tips of the stems are enlarged and that the larval chamber is in the apex.

A superficial examination of the gall of *Callirhytis clavula* Fitch (Fig. 33 a. b c. d.) shows no resemblance to the preceding galls except in location at the tip of the stem. The gall is apparently



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a mere enlargement of the tip of the stem, and containing one or more larval chambers. Examination of section under a compound microscope, however, reveals a condition similar to that described for C. solidaginis and C s -strobiloides. Each larval chamber is in reality the apex of a bud. The young leaves of the bud are closely applied to each other and their structure unaffected by the insect. As the gall developes the leaves do not unfold but assume a corky texture and in the fully mature gall their identity is almost lost.

It is very evident that the larval chamber occupies a corresponding position in each of these galls The insect prevents the elongation of the stem, thus causing the leaves of the apical bud to be bunched and reduced in size. The fact that the leaves of the Solidago reach the greatest development and those of the Quercus the least development is probably due to the character of the plants. Of these three plants the growth of the Solidago is the most rapid while that of the Quercus is the slowest. In Solidago the rapid growth may be sufficient to overcome the injury and cause the bunch of leaves, in the Salix where the growth is not so rapid the leaves are smaller and more compact, in the Quercus where the growth is slowest the bud never opens but becomes corky and the leaves gradually lose their identity

This work was pursued during the year 1901-2 in the Zoological Laboratory of the Ohio State University under the direction of Professor Herbert Osborn to whom I am indebted for many valuable suggestions

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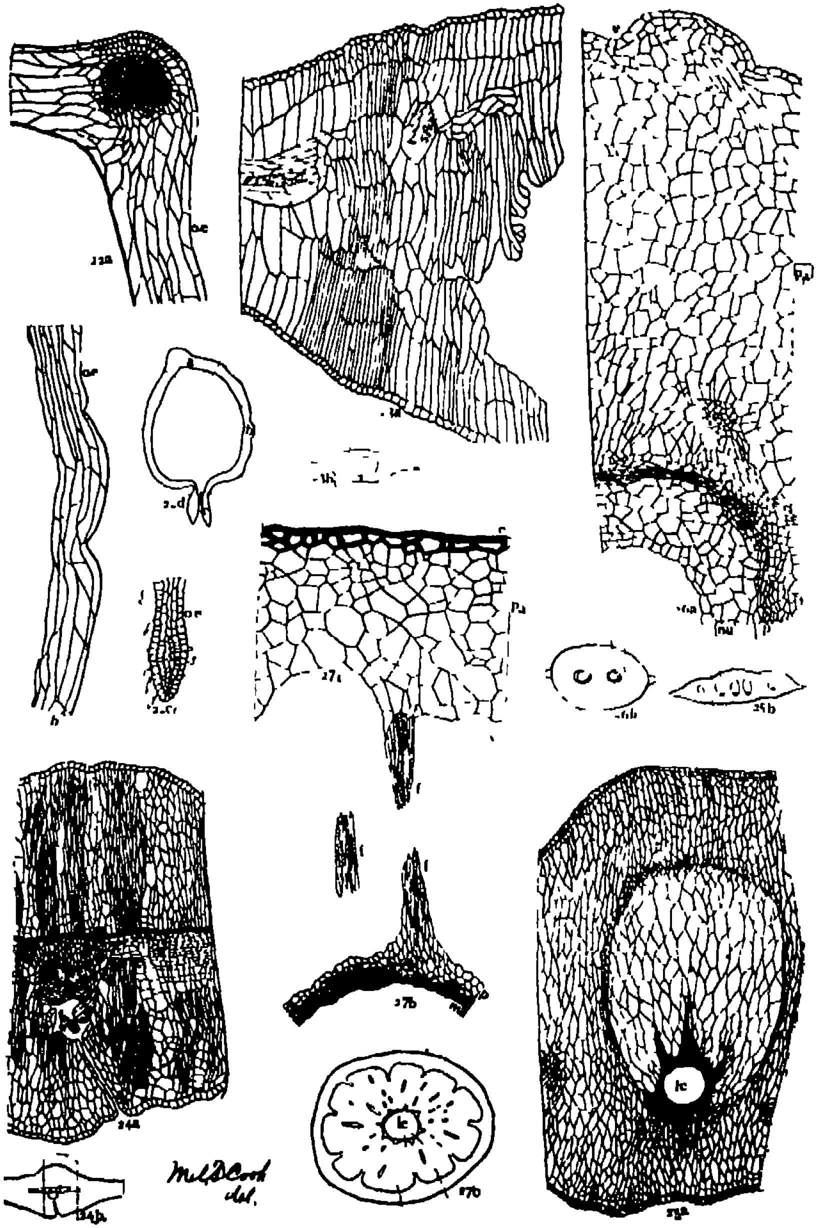

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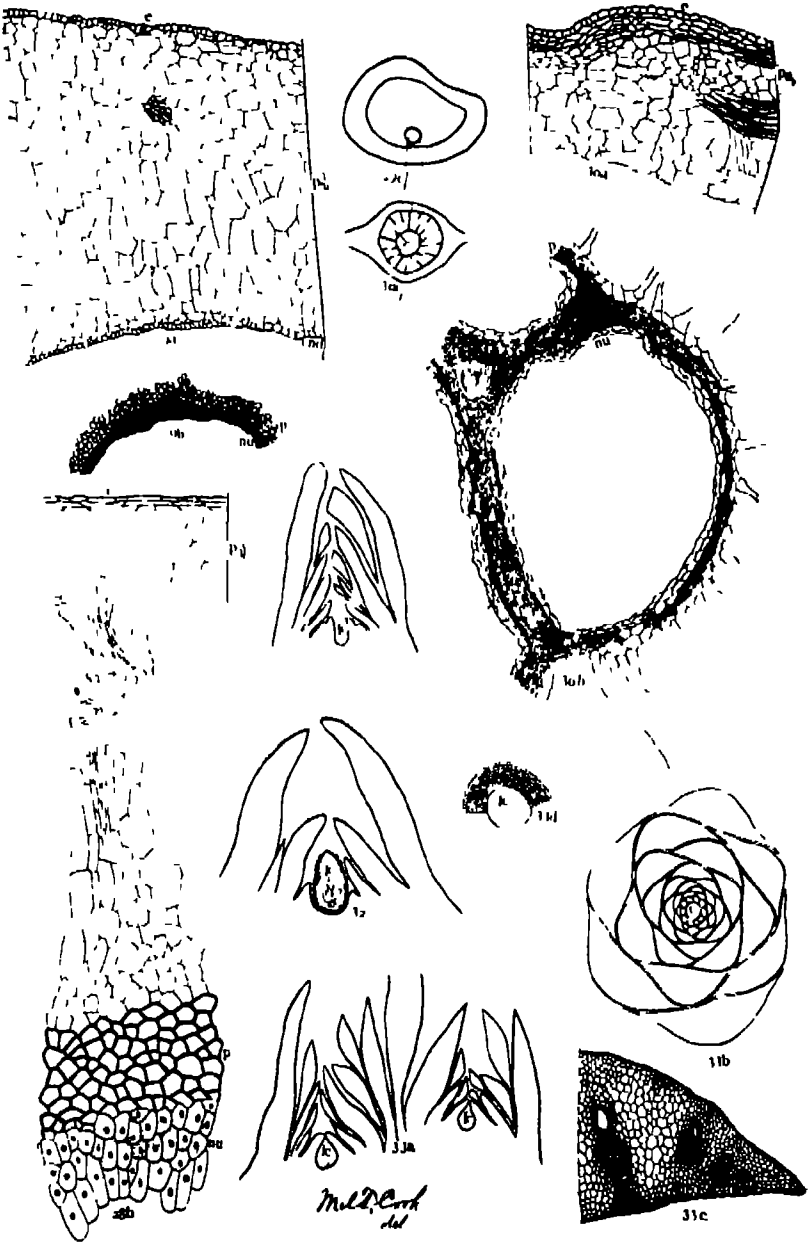

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EXPLANATION OF PLATES

In making the drawings a Bausch and Lomb microscope and camera lucida were used Figs 1 7 were made with 1 inch ocular and 1-5 inch objective The diagrams of the galls were not made upon a definite scale All other drawings were made with 1 inch ocular and 23 inch objective

Abbreviations
e —epidermis
end —endodermis
f —fibro vascular bundle
l c —larval chamber
nu —nutritive zone
o e —outer epidermis
p —protective zone
pa —parenchyma

1 Cross section of leaf of Hicoria ovata
2 Salix cordata
3 Vitis vulpina
4 Ulmus americana
5 Acer saccharinum
6 Tilia americana
7 Quercus alba
8 a b Phytoptus ulmi on Ulmus americana
9 a b abnormis on Tilia americana
10 a b quadripes on Acer saccharinum
11 a b acericola
12 Schizoneura americana on Ulmus americana
13 a b Colopha ulmicola on Ulmus americana
14 a b Pemphigus ulmi fusus on Ulmus americana
15 a b Hormaphis Hamamelis on Hamamelis virginiana
16 a b Phylloxera carya avena on Hicoria ovata
17 a b c fallax
18 a b c globuli
19 a b spinosa
20 a b depressa
21 a b vastatrix on Vitis vulpina
22 a b c d Cecidomyia gleditsiae on Gleditschia triacanthos
23 a b pilulae on Quercus alba
24 a b verrucola on Tilia americana
25 a b Neuroterus irregularis on Quercus macrocarpa
2 a b Callirhytis tumifica alba
27 a b c Holcaspis centricola palustris
28 a b Amphibolips inanis rubra
29 a b c Dryophanta palustris palustris
30 a b c Callirhytis papillatus sp
31 Longitudinal section of Cecidomyia Solidaginis on Solidago
32 salicis-strobiloides on Salix cordata
33 Callirhytis clavula on Quercus alba
a Longitudinal section
b Cross section
c of leaf from b
d of larval chamber from b

NOTE —P vastatrix was also collected on V bicolor C pilulae was also collected on Q rubra and Q palustris

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FURTHER ADDITIONS TO THE CATALOGUE OF OHIO PLANTS

W. A. KELLERMAN AND F. J. TYLER

The species named below have not been reported before for the Ohio Flora. The first collector and locality are given for each species and a serial number prefixed to show the position of each in the Fourth State Catalogue. The Third Annual Supplement to the State Catalogue is issued simultaneously with the following list and contains a list of species reported since the second Supplement was published. An alphabetical list of all species reported since the publication of the Fourth State Catalogue is also included therein. Copies of the Supplement will be sent gratis to those requesting the same.

66*a* **Selaginella apus (L.) Spring. Creeping Selaginella. Perry, Lake Co. Otto Hacker.**

68*a* **Pinus echinata Mill. Yellow Pine. Spruce Pine. Auglaize Co. A. Wetzstein.**

84*a*. **Potamogeton heterophyllus myriophyllus (Robbins) Morong. Many-leaf Pondweed. Stark Co. W. A. & K. F. Kellerman.**

235*a* **Poa nemoralis L. Wood Spear-grass. Lake Co. Otto Hacker.**

680*a* **Humulus japonicus Sieb. & Zucc. Japan Hop. Escaped Toledo, Lucas Co. F. H. Burglehaus.**

715*a*. **Polygonum punctatum robustior Small. Water Smartweed. Painesville, Lake Co. Otto Hacker.**

771*a* **Silene antirrhina divaricata Robinson. Spreading Catchfly. Gallia Co. W. A. Kellerman.**

803 *a*. Scleranthus annuus L Knawell German Knotgrass. Painesville, Lake Co. Otto Hacker

887 *a* Lepidium draba L Hoary Cress Lucas Co F. H Burglehaus

898 *a*. Brassica oleracea L Cabbage Preble Co W. A Kellerman

965 *a* Ribes uva-crispa L Garden Gooseberry Escaped. Ironton, Lawrence Co and Columbus, Franklin Co W. C Werner

988 *a* Rubus canadensis L (R millspaughii Britt) Millspaugh's Blackberry Ash Cave, Hocking Co W A and K. F Kellerman

1014 *a*. Agrimonia pumila Muhl Small Fruit Agrimony Huron Co Otto E Jennings

1015 *a* Agrimonia brittoniana Bick Britton's Agrimony Farmer's Station, Clinton Co C P Ingold

1022 *a* Rosa nitida Willd Northeastern Rose Painesville, Lake Co Otto Hacker

1025 *a* Rosa gallica L French Rose Escaped Painesville, Lake Co Otto Hacker

1148 *a* Linum perenne L Perennial Flax Painesville, Lake Co Otto Hacker

1163 *b* Mercurialis annua L Mercury Plant Painesville, Lake Co Otto Hacker

1260 *a* Viola palmata sororia (Willd) Poll Bowling Green, Wood Co W A Kellerman

1263 *a* Viola emarginata (Nutt) LeConte Painesville, Lake Co Otto Hacker

1344 *a* Chaerophyllum procumbens shortii T & G Short's Chervil. Clermont and Butler Counties J F James, Hamilton Co C J Herrick

1431 *a* Gentiana flavida A Gr Yellow Gentian Lucas Co F H Burglehaus

1561 *a* Monarda mollis L Canescent Wild Bergamot Erie Co W A Kellerman and F J Tyler, Cuyahoga Co J R Watson

1632 *a* Veronica chamaedris L Germander Speedwell Painesville, Lake Co Otto Hacker

1756 *c*. Hypochaeris radicata L Long rooted Cat's Ear Painesville, Lake Co Otto Hacker

1825 *a* Solidago erecta Pursh. Slender Goldenrod Ash Cave and Goodhope tp , Hocking Co , Pomeroy, Meigs Co W A Kellerman

1926 *a* Crassina elegans (Jacq) Kuntze (Zinnia elegans Jacq) Zinnia Escaped Gallia Co W A Kellerman

1973 *a* Galinsoga parviflora hispida DC. Hispid Galinsoga Painesville, Lake Co Otto Hacker

THE SUMMER BIRDS OF LAKE ERIE'S ISLANDS.

LYNDS JONES

During the year several places in the state were visited in the interest of the 'Revised Catalog' The first in April, to McConnelsville in Morgan county, a second to Medina, in Medina county, and a third to the islands of Lake Erie, not to mention several minor trips It is of the third of these principal trips that I wish to speak, because it was planned with special reference to work on the 'Revised Catalog,' and was of more value as determining the northern range of several species whose summer homes are supposed to lie much farther south

This field work was planned in conjunction with Rev W. L Dawson, of this city, with whom the best of my ornithological work has been done A kindred spirit with whom such work becomes recreation of the most satisfactory kind.

Family, church and college duties prevented an earlier start than the 5th day of August True, that was pretty late to study the summer birds, many of which must be in the annual molt, but, as it proved, there were but few from farther north, and those among the water birds We were most concerned about the land birds which regularly breed upon these islands

The landing on Middle Bass at six on the evening of the 5th left little time for study of the birds before going into camp The best part of the next morning was given to a study of the birds swarming on the mud flats of the lagoon back of the large wine cellars. Such a company of swamp loving birds as here greeted us it has never been my privilege to see elsewhere. Of the 15 species recorded the Least and Semipalmated Sandpipers, Semipalmated Plovers and King Rails were the most interesting Of the 42 species recorded for this island, there was nothing else of any special interest

A row boat proved the only available conveyance, and with the light airs usually prevailing, was very satisfactory Twice the seas ran high, but that served only to add zest to our outing

A day spent on North Bass yielded little of interest among the 34 recorded species, except a Carolina Wren, in the hedge by the church, and a pair of hoary old Bald Eagles spooning in their nest near the west side No Yellow Warblers were seen north of this island.

The island commonly known as Big Chicken—the most southerly of the group of the Hen and Chickens—proved second only in interest of all the islands visited Apparently formed by the stones pushed up by the ice during late winter, it stands 15 or 20 feet clear of the water, the loose stones thrown into windrows by ice and waves. Two fair sized trees and a bed of nettles are the only land vegetation. A small fish-house stands under the larger tree, and seems to furnish a shelter for the terns during violent storms Here we found only Common and Black Terns and Spotted Sandpipers and a single Bronzed Gackle No doubt the sandpipers had reared their young here Of the terns we estimated the Black at 20 and the Common at 2000 individuals, many of the latter young of the year A careful count of the nests and eggs and squabs resulted as follows Nests with eggs 232, without eggs 94; eggs 370, squabs 26, very young 25 Of the eggs by far the larger proportion were cracked and dry Perhaps a quarter of them were pipped or almost ready to hatch A few were rotten without being dry

The Chick island lies about a quarter of a mile a little east of due north from Big Chicken It is a narrow rock reef, which the waves would easily wash over in storms were there water of more than a foot in depth within several rods of it Smart weeds (Polygonum) grow in abundance along its eastern side Here we saw some 1500 Common and 500 Black Terns, 20 American Herring Gulls, which were knee deep in the water on the north west extending reef, two Black Ducks and two Spotted Sandpipers Fifty-one nests of the Common Tern were counted here, with the proportion of eggs and young as on Big Chicken

If the first island be called Big Chicken, and the smallest one Chick, why not call the middle sized one just Chicken? Anyway it is another rock reef with relatively little drift rock anywhere upon it It lies well above storm waves because the water about it is so shallow There is an abundant growth of smart weed, even to the water's edge, with a bunch of willows, each of which is about 6 inches in diameter, besides a considerable growth of smaller willows along the north side, The back-bone of this reef is without any sort of vegetation. Here the Common and Black Terns, the same two Black Ducks, and three Spotted Sandpipers greeted our arrival. There were 71 nests of the Common Tern on this rock. The Black Terns numbered about 200 individuals, and the Common perhaps 1700. The Black Terns were clearly not breeding on any of these islands, nor were the American Herring Gulls. The heat upon the rocks was so excessive that it seemed extremely doubtful if any of the very young terns could survive. The nests were fairly well made of grass and drift material, but were exposed to the weather. I noticed one nest which was nothing but a dry fish.

We were a little surprised to find Red-winged Blackbirds and Bronzed Grackles evidently breeding on the high and dry Hen island. Here, too, the House Wren had found a domicil. The seven acres of this loam-covered rock are covered by a considerable growth of hackberry trees, with a few rock maples interspersed, and a liberal fringe of willows. A fine peach orchard is an acquisition. Also a few plum trees The club and dwelling house have driven the gulls and terns away.

The row to North Harbor in the gloaming discovered to us converging lines of Purple Martins. A near approach to the island revealed the point of convergence to be the largest tree on the island, at its southernmost point It was not possible to even estimate approximately the numbers forming this roost, but the tree was clearly well filled There must have been 2000 birds among its branches We thought we had heard and seen terns before Camp had to be pitched right in the midst of them Here we had the first sight of terns roosting perched upon the trees. They were a little awkward in getting settled, but seemed perfectly at home once the wings were safely folded

The dense growth of trees and brush, over the largest part of the island, made a count of the nests impossible It is safe to say, however, that the population exceeded all that we had thus far seen Here, too, we found nests and dry eggs of Red-winged Blackbirds and Bronzed Grackles Here, on this most northern outlier of the group, were Wood Pewee, Kingbird, Cedar Waxwing, Goldfinch, and even Carolina Wren, and a probable Red-eyed Vireo On the sunny eastern side we saw the most very young terns, and several well fed black snakes The birds and snakes seemed to be the only land vertebrates

The island itself is interesting, and but for the terns would be a delightful place to spend the summer months were it not so far from any base of supplies Where the rocks are exposed they are deeply furrowed by glacial scratches.

A few hours spent on East Sister island was fruitful in the discovery of species not seen hitherto Here, again, were the Carolina Wrens and the others seen on North Harbor, and besides them the Cardinal, the Marsh Hawk, Crow, Indigo Bunting, Song Sparrow, Yellow-billed Cuckoo, Redstart and Robin East Sister is an island so large in extent and so varied in physical features and vegetation that one is not surprised to find a large and varied bird population. Of course these six islands the Hen and three Chickens, North Harbor and East Sister, do not belong to Ohio, being in the Canadian possessions, but they lie so directly in continuation with the Bass group that a study of their population is necessary to understand fully the more southern islands.

This brief study of this really large group of islands proved what I had every reason to expect, that it is by this route that many of our migratory species reach Canada. It forms a natural highway for the birds of weaker wing who wander westward along the shore of the lake to find here an easy crossing place. And it is this stream of migration whose strong current sweeps along with it such usually southern species as the Cardinal and Carolina Wren until they find congenial quarters upon the islands well to the north where the rigor of winter and the heat of summer are both alike tempered by the surrounding lake.

The islands visited were Middle and North Bass, Sugar, the Hen and three chickens, North Harbor, East Sister—nine in all. Fifty-eight species were recorded for the whole archipelago, 42 of which were found on Middle Bass. Of these 58 species there were possibly six which were from further north, having already started on their southward journey.

During the spring migrations this chain of islands should be a Mecca for the bird student. There can be but little doubt that it is the highway for many rare species.

Oberlin, Ohio.

A NEW PHENACOCCUS ON PLATANUS OCCIDENTALIS.

J. G. SANDERS.

Phenacoccus (*Paroudablis*) *osborni*, *n. sp.* – Female (adult) is 2 to 2½mm in length, and 1 to 1¼mm in breadth, is flesh-colored and covered with a slight, white powdery secretion. There are seventeen very short, inconspicuous, lateral filaments on each side. Although the filaments are short, spinnerets and numerous hairs are scattered over the surface of the body, being especially numerous in the cephalic region. On the anterior ventral margins of the second and third segment, are two large spiracles. The anal lobes, bear each, two long hairs and three short ones, besides the spines. The large, retracted anal ring bears the customary six long hairs, and is conspicuously dotted. The eyes are prominent, though not large. The antennae are eight jointed, the eighth joint, in many specimens, having a tendency to divide. The formula is as follows: 8, 3, 2 (4, 5,) 1 (6, 7). The legs are well developed and darker in color than the body, the tibia being nearly three times the length of the tarsi, and bearing a pair of strong spines on the distal end. Numerous hairs are borne by the tarsi but no noticeable digitules. A pair of knobbed digitules is borne by the long single-toothed claws.

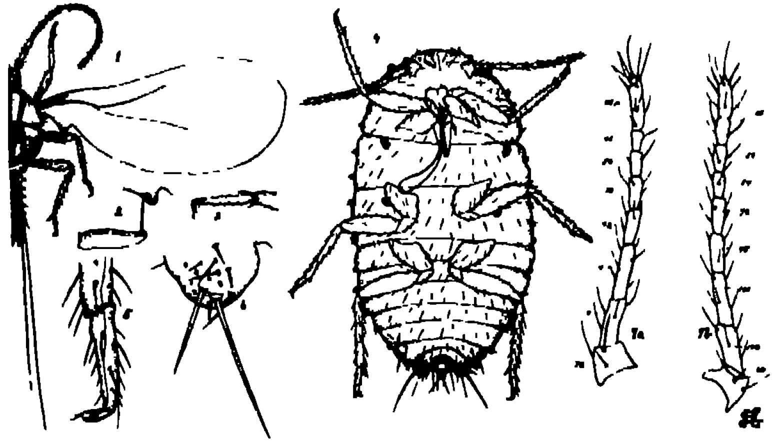
The eggs are long elliptical, golden-brown, rather firm, measuring 3mm. x 15mm.

Male (adult) is an active, well-constructed insect, the thorax constituting one-half the length of the individual. Measurements: From tip of head to tip of abdomen, .85mm., wing expanse, 2.8mm. From tip of head to tip of folded wings along dorso-median line, 1.5mm., length of wing, 1.25mm., width of wing, 55mm., length of balancers, .1mm. Caudal filaments, two about 1.25mm., and two about 1mm. in length. Front legs, femur 25mm., tibia .35mm., tarsus, .12mm., claw .03mm in length. Hind legs, femur .3mm., tibia .4mm., tarsus .13mm., claw 03mm in length. Antennae are 1mm. in length, the joints measuring, 1st, 45mmm., 2nd 60, 3rd, 160, 4th, 150, 5th, 135, 6th, 120, 7th, 96, 8th, 75, 9th, 63, 10th, 90. Formula: 3, 4, 5, 6, 7, 10, 8 (9, 2,) 1.

Color Head, dark reddish-brown, eyes, blackish; thorax, reddish-brown except dark, chitinous parts; abdomen light-brown tinged with yellow. Antennae, reddish-brown, legs, brown to olivaceous with dark-brown tarsi Caudal filaments, white, wings, semi-transparent with iridescent rose-tint in strong light Balancers, darker, slightly chitinous on costal margin, bearing one long, hooked claw which fits into a pocket in the wing

Although the head is very small and much reduced, and bears four reddish ocelli, the thorax is very large and well developed and bears a black, shield-shaped chitinous plate on the meso-scutum, from which three dark, chitinous bands extend to the anterior margin of the thorax

The legs are long and hairy for their entire length, the tibia bear a pair of strong spines on their distal extremity, the tarsi are armed with numerous spines, the claws are long and curved, and bear a sharp denticle on the ventral margin, near the tip. Two knobbed digitules are present, extending beyond the tip of the claw



EXPLANATION OF PLATE

Fig 1 - Adult male Fig 2—Balancer with hook fitting into pocket in wing Fig 3—Posterior tarsus of male Fig 4—Adult female Fig 5—Posterior tarsus of female Fig 6—Lateral lobe of abdominal extremity of female Fig 7a—Left antenna of female Fig 7b Right antenna of female

The males were found emerging from the pupa-cases from April 13 to 18, and taking wing readily

The females were found, during the winter, under loose bark on the trunks and larger limbs of *Platanus occidentalis* on the campus of Ohio State University at Columbus Not abundant.

A Chalcid parasite was reared from specimens collected in February.

The above description and drawings were submitted to Prof. T. D A Cockerell, to whom the author is greatly indebted for his expert opinion and valuable suggestions. Prof. Cockerell says, "It appears to be a perfectly good species," and adds, "There is a *Phenacoccus platani* on Platanus in Europe. This differs from your insect as follows: (1) It (female) is larger, nearly 4mm long. (2) It has a dorsal band. (3) It has the second antennal joint longer than the third (which is also the case in *P. helianthi*, *P. solenopsis*, *P. wilmattae*, etc.

"*Phenacoccus piceae* has the same size as your species, but it also has the long second joint, its color is orange or pink, and the male is pink or flesh color, with the apodema and scutellum red. It lives on *Abies* in Austria."

SOME ADDITIONS AND CORRECTIONS TO THE LIST OF LAND AND FRESH WATER MOLLUSCA OF TUSCARAWAS CO., OHIO.*

Dr. V. Sterki.

After 53 add: Conulus chersinus Gld. Common. It seems to be distinct from fulvus.

64 is Limnaea kirtlandiana Lea, near reflexa Say.

After 66 add: Limnaea umbilicata Ad. Pools and ditches, scarce.

67 is Limnaea caperata Say. It is very common in Summit and Portage Counties.

82 and 86 are good species, according to Walker, but are not yet published.

88 Physa gyrina Say is regarded as a distinct species by leading conchologists, 89 may be a small local form of it.

After 88 add: Physa elliptica Lea, according to Walker. Pools and ditches, not common.

90 is Physa integra Say.

91 may be glabra DeKay, equals elongatina Lewis. So writes Mr. Bryant Walker, who is examining it.

92*a* Campeloma rufa Hald. Not common; ditches. A rather elevated form.

105 to 145. Since the list was written, C. T. Simpson's Synopsis of the Naiades (Unionidae) has been published. In this a number of additional genera are recognized, and some specific names changed. It would take too much space here to enumerate the changes in detail; the species in the list in themselves are correct except 143 and 144, which are mere forms of Anodonta grandis.

After 146 add: Sphaerium solidulum Pr. Tuscarawas River and races.

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* Eighth Annual Report of the Ohio State Academy of Science, p. [illegible]o

After 153 add · Calyculina truncata Linsley Pools and ditches, common It is distinct from C partumeia and securis

After 163 add Pisidium trapezoideum Sterki. Spring brooklet in Stone Creek Valley and ditches The species is known from Pennsylvania to North Carolina and Michigan

In the printed list there is a large number of typographical errors. A few of them may be corrected here

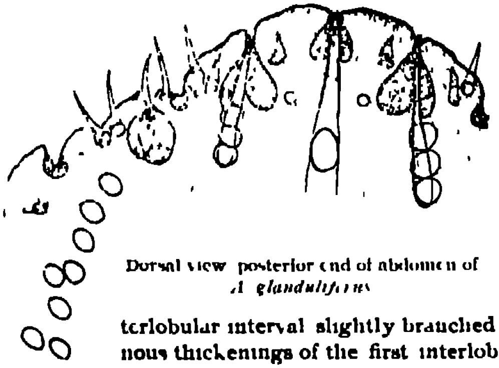
No 28 should be curvidens, 44, exiguus, 70, bicarinatus, 98, Pomatiopsis, 100, Pleurocera, 101, lithasioides, 108, subovatus, 117, verrucosus, 145, hermaphroditic, 157, cruciatum

A NEW ASPIDIOTUS FROM PINUS SYLVESTRIS.

T D A Cockerell

Aspidiotus (*Diaspidiotus*) *glanduliferus* n sp Female scale large, 2 mm diameter, slightly convex, blackish (the color of the bark), with large subcentral to sublateral orange-ferruginous or almost vermillion exuviae, readily exposed by rubbing Removed from the bark, the scale leaves a conspicuous white patch Male scale oval, broad, with covered exuviae and a white dot and ring

Female, broad oval, with a deep constriction between head and thorax, the thoracic segments also strongly marked by lateral constrictions Color bright orange, caudal margin stained with dark red brown Anal orifice extremely small, level with second dorsal gland of first row Five groups of circumgenital glands, median 4, anterior laterals 16 to 17, posterior laterals 7 to 8, Dorsal pores very numerous, in four series, the first (below first interlobular incision) of three in a row, the second of 17, and then after a short break, 9 more, the third of over 30, the fourth (in an irregular line commencing near the margin) of about 11 Median lobes very large but broad and low, hardly at all produced, second lobes similar but smaller and more or less serrulate on the margin, third lobes represented by a small angular prominence, plates spine-like, the larger one of the first interlobular interval slightly branched, spines quite large, chitinous thickenings of the first interlobular interval rather short and thick, straight, subequal, but the inner the larger



Dorsal view posterior end of abdomen of *A glanduliferus*

Habitat Abundant on small branches of *Pinus sylvestris* on the campus of the Ohio State University, Columbus, O, collected by Mr J G Sanders On the leaves of the same tree are some *Chionaspis pinifoliae* Fitch.

A. glanduliferus is related to *A. ostreaformis*, and has, I suspect, been introduced from Europe, although not yet known there. It is very easily distinguished from *ostreaformis* by the much more numerous dorsal glands, the form of the second lobe, and the position of the anal orifice; the shape of the female is also different.

It is also closely allied to *A. fernaldi* Ckll., but that, while similar in the shape of the insect and the form of the lobes, differs by the very unequal processes of the first interlobular interval, the much smaller anterior lateral groups of circumgenital glands, and the fewer dorsal glands, which are in *fernaldi* about as follows First series of 3, second of 9, third of 13, fourth of 8.

It is also close to *A fernaldi albiventer* Hunter, but that has not enough dorsal glands; the form of the median lobes is different, and the anterior lateral group of glands does not exceed 12. (*A. fernaldi albiventer* is the same as *A fernaldi cockerelli*; the Canadian Entomologist containing the latter was published before the Kansas University Quarterly containing the former, but Prof. Hunter privately distributed separates in December, before the Can. Entomologist appeared. Mr. Parrot's designation was the first in Mss.)

A. glanduliferus differs from *A erhornii* Coleman Mss (on *Abies* in California) by the much smaller anal orifice, more numerous dorsal glands, well developed second lobe, shape of insect, etc.

MOULDS INJURIOUS TO FOODS.

MARY DRESBACH

The moulds include a number of exceedingly common saprophytes which make their appearance on various kinds of organic matter. They differ greatly in form, size and color and belong to widely separated orders As a rule the vegetative state consists of filaments or hyphae which intertwine or interlace, giving rise to an aracnoid or felt-like mycelium. Many of these organisms, especially the common moulds, occasionally pass through a sexual reproductive stage, though more commonly reproduction is accomplished by means of nonsexual spores or conidia.

The various groups of moulds are widely distributed and grow very easily. When the spores are set free they are caught in currents of air and held suspended in the atmosphere to such an extent that in most living rooms hundreds of spores are floating around. The nonsexual spores are produced in such enormous numbers that whenever a proper food supply and proper environment are at hand an abundant crop of mould is developed.

Proper methods of checking or preventing the growth of moulds should receive serious attention, since these fungi form an important problem in the household, and also in the army where the preservation of bread and other articles of food for considerable periods of time is necessary.

The following are orders and families of fungi which contain species injurious in the household.

Bacteriales—Coccaceae, Bacillaceae, Spirillaceae
Mucorales—Mucoraceae
Saccharomycetales—Saccharomycetaceae
Aspergillales—Gymnoascaceae, Aspergillaceae
Moniliales—Mucedinaceae, Dematiaceae, Tuberculariaceae.

The following is a list of the more important moulds

Mucoraceae

Mucor stolonifer Common bread mould Grows on bread, cake, decaying fruit and vegetables
Mucor mucedo. On fruits, bread, etc
Mucor racemosus On decaying vegetables, fruit, and bread.
Mucor spinosus On moist bread and decaying vegetables.
Mucor rhizopodiformis Not uncommon on moist bread
Thamnidium elegans On various articles, as bread, paste, etc

Aspergillaceae

Penicillum crustaceum The most universal mould in the world. On decaying or preserved fruits, bread, pie, milk, potatoes, chocolate, etc.
Aspergillus herbariorum. A universal mould on bread, cheese, peach preserves, plum butter, mince meat, etc
Aspergillus repens. Grows in the same substrata as A. herbariorum
Aspergillus niger On moist vegetables

Mucedinaceae

Oospora lactis On milk and cheese
Oospora fasciculata On oranges
Monilia fructigena On peaches, plums, and cherries.
Trichothecium roseum On various plant and animal products, fruits, vegetables, sweet potatoes, etc

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AN ADDITION TO OHIO BIRDS.

Mr. Irving A. Field, of Dennison University, Granville, announces the capture of a European Widgeon (Mareca penelope) on the Licking Reservoir, Saturday morning, March 29, 1902, by Mr. Peter Hayden of Columbus. This European species has been found in the eastern parts of the United States several times, but this is the first one on record for Ohio It is the more interesting as coming from near the center of the state. Ohio's artificial bodies of water have proved great attractions to more than one rare species of birds.

Lynds Jones.

ROSETTE PLANTS OF OHIO.

FREDERICK J TYLER.

Among the many forms of vegetation represented in Ohio, the rosette is not the least interesting and remarkable. There are about 155 species and varieties of plants in the State which exhibit this habit during some period of their life history and since many of them are very abundant and some are classed as bad weeds, they form a conspicuous and important part of the flora.

Rosette plants are characterized by a basal tuft or whorl of leaves which may be persistent (perpetual rosettes, as the common Dandelion) or may disappear as the plant reaches maturity (temporary rosettes, as the Mulleins and most other rosette-biennials). This basal tuft of leaves is due to a shortening (non-development) of the internodes of the stem, thus bringing the leaves close together The amount of stem reduction may be approximated by counting the number of leaves in a rosette and comparing with the number of leaves on a flowering stem of the same plant The stem forming the central axis of the rosette of Onagra biennis, the common Evening Primrose, will be found to bear 50 to 70 times as many leaves as the same space of flowering stem In other words a stem length of 13 to 17 in. has been shortened to ¼ in.

The advantage of the rosette habit is chiefly in the protection which it affords from extremes of temperature and from drying winds, browsing animals, etc The typical rosette rarely projects more than an inch or so above the ground and the leaves are usually spread out flat upon the surface. In Winter the rosette is well protected by even a light blanket of snow and is often partially covered by the debris of higher vegetation which has been cut down by frost.

In this latitude the majority of rosette plants are biennials, that is, plants which complete their life cycle in two years, spending the first year in getting a foothold, establishing a strong root system, and usually in storing up some reserve food material. The next year they start out vigorously on their lifework of producing seed. It is easily seen that the rosette habit is peculiarly adapted to the needs of a biennial during its first year's growth. It is compact, well protected for the Winter and the preservation of reserve food material is made easy. But for the all important work of the second year the rosette is not at all adapted Now it is too compact, only a limited amount of foliage can be borne by the short stem, and not enough space can be given to the production of flowers and fruit. So the biennial abandons the rosette habit at the beginning of the second growing season and grows up into a tall, branching herb Familiar examples are the Turnip, Salsify, and Parsnip of the garden. The natural tendency of the rosette plant, in these cases, to store up food for the second year's growth is taken advantage of by gardeners and a valuable food plant results.

In the temperate zone, under the favorable conditions for plant growth that obtain in our State, not many perennials find it advantageous to retain the rosette habit beyond the critical period in their life history which lies between the sprouting of the seed and the establishment of a strong, underground stem or root system. At this period the rosette is replaced by an aerial, flowering stem as, for example, with the Canada Thistle, Carduus arvensis. This fact is noted by Prof Lyster H. Dewey in Bulletin 27, Div. of Bot., U S. Dept. of Agr. He says: "Canada Thistle is usually first introduced into new localities by the seed The seed germinates and a rosette of leaves lying almost flat on the ground is first formed. * * The following year a flowering stalk branching at the top grows up to a height from one to three feet (20 to 100cm) rarely higher."

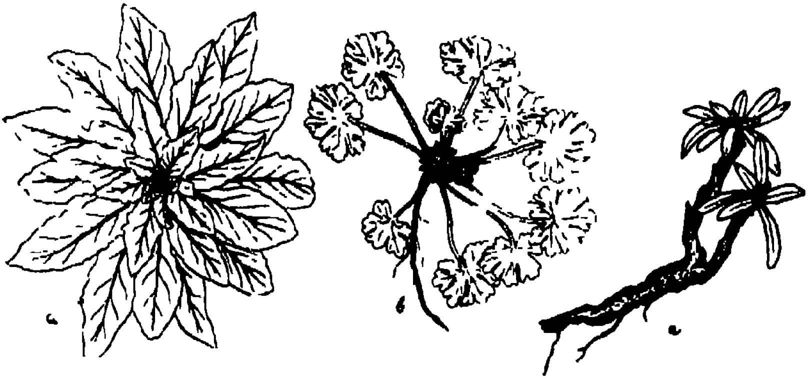

Fig 1 *a*, close rosette of Onagra biennis, *b*, open rosette of Geranium carolinianum, *c*, perpetual rosette of Tetraneuris acaulis

The perennials which retain the rosette habit throughout their life history may be termed perpetual rosettes. In Ohio they are few in number and are mostly scapose or acaulescent plants as the Dandelion, Taraxacum taraxacum, English Daisy, Bellis perennis, Lakeside Daisy, Tetraneuris acaulis, and Plantain, Plantago sp.

One group of perpetual rosettes, however, is not acaulescent, having solved the problem of being low rosette plants and at the same time having aerial flowering stems. This is accomplished by the plant sending out lateral branches from the axils of its rosette leaves. These lateral branches grow outwards and upwards, flowering and fruiting freely but not enough to exhaust the plant. Examples are the early Avens, Geum vernun; and Tooth-leaved Cress, Arabis dentata.

Under less favorable conditions the perpetual rosette is more abundant. In dry, tropical deserts, for instance, a certain specialized form of the rosette is very common. This is the succulent leaf type (Agave, Echeveria, Sempervivum, etc.) Also in Alpine and Polar regions the perpetual rosettes occur in great numbers.

A few annuals form a small and imperfect rosette soon after sprouting from the seed and before they send up an aerial stem, and at least two annuals in our Flora are acaulescent. These are Plantago aristata and Plantago virginica. Most of the advantages of a rosette habit are lost to an annual so that one may well believe that an annual rosette plant was once longer lived than it is now.

Rosettes may be termed open or close when the leaves are loosely arranged, as with the Cranesbill, Geranium molle; or crowded, as with the Evening Primrose, Onagra biennis. In a few cases the rosette is not basal but is located at the end of a leafy stem of some length as with the common sedum, Sedum ternatum. Rosettes of leaves are formed three or four feet above the ground, on the end of stems of Polymnia canadensis, and are brought down close to the surface in Autumn by the reclining stems. In this latitude, however, they do not survive the Winter

Rosette plants exhibit some interesting adaptations for protection from cold, such as the geotropic curvature of the leaves and the development of red color If a leaf of a rosette of Smooth Mullein, Verbascum blattaria, or of the common Teasel, Dipsacus sylvestris, be examined late in October it will be seen that it is pressed tightly against the surface of the ground, and if the entire plant is dug up and placed in a collecting case for a few hours the leaves will be found turned downwards so far that they are parallel with the tap root and form a cup around it During the same season of the year the leaves of many rosette plants are quite red or purple. This is due to a substance known as anthocyan. It is the same red coloring matter that is present in the unfolding leaves and twigs of Red Maple, Acer rubrum, and Soft Maple, Acer saccharinum Anthocyan changes some of the rays of light, which pass through it, into heat and is of much importance in the economy of the plant during the cold days of Autumn and Spring. The leaves of a close rosette are often arranged very nicely to prevent the lower being shaded. This is accomplished by a spiral arrangement and by the elongation of petioles of lower leaves.

It might be expected, in case of perpetual rosettes, that the plant would gradually grow out of the ground but this is counteracted by a shortening of the roots which pulls the plant back. Sometimes the rosette is pulled down so as to form a small pit, at the bottom of which is the terminal bud This can be well seen in case of the Dandelion in Autumn. Probably this serves to protect the plant from cold as well.

In making up a list, such as follows, one soon finds that a line must be drawn where none exists and that plants must be excluded that are very little different from some that are included. In any such group a series of gradations may be found that lead to one or more other groups. In these lists only those plants have been included in whose life history the rosette plays quite an important part.

LIST OF BIENNIAL ROSETTE PLANTS.

Alliaria alliaria
Arabis canadensis
Arabis brachycarpa
Arabis glabra
Arabis lyrata
Arabis laevigata
Arabis hirsuta
Arabis patens
Arabis virginica
Arctium lappa
Arctium majus
Arctium minus
Barbarea barbarea
Bursa bursa-pastoris
Cardamine hirsuta
Carduus altissimus
Carduus discolor
Carduus lanceolatus
Carduus muticus
Carduus odoratus
Carduus virginianus
Carum carui
Cichorium intybus
Cynoglossum officinale
Daucus carota
Digitalis lutea
Digitalis purpurea
Dipsacus sylvestris
Erysimum cheiranthoides
Erysimum asperum
Frasera carolinensis
Gaura biennis
Gaura parviflora
Gnaphalium decurrens
Gnaphalium purpureum
Lactuca canadensis
Lactuca floridana
Lactuca hirsuta
Lactuca sagittaefolia
Lactuca saligna
Lactuca scariola
Lactuca spicata
Lactuca spicata integrifolia
Lactuca virosa
Lappula virginiana
Lepidium apetalum
Lepidium campestre
Lepidium virginicum
Linaria canadensis
Lithospermum arvense
Lobelia leptostachys
Lobelia spicata
Lychnis coronaria
Mariana mariana
Oenothera lacinata
Oenothera rhombipetata
Onagra biennis
Onagra biennis grandiflora
Onagra oakesiana
Onopordon acanthium
Pastinaca sativa
Potentilla argentea
Potentilla canadensis
Potentilla monspeliensis
Potentilla paradoxa
Potentilla pumila
Ranunculus abortivus
Ranunculus micranthus
Ranunculus sceleratus
Raphanus raphanistrum
Raphanus sativus
Roripa palustris
Rudbeckia hirta
Salvia lyrata
Sisymbrium altissimum
Sisymbrium officinale
Sophia pinnata
Tragopogon porrifolius
Tragopogon pratensis
Verbascum blattaria
Verbascum thapsus.

ANNUAL ROSETTE PLANTS.

Adopogon carolinianum
Bursa bursa-pastoris
Camelina sativa
Crepis tectorum
Crepis virens
Draba caroliniana
Draba verna
Echium vulgare
Erigeron annuus
Erigeron ramosus
Erodium cicutarium
Geranium carolinianum
Geranium columbinum
Geranium molle
Geranium pusillum
Gnaphalium obtusifolium
Leptilon canadense
Plantago aristata
Plantago virginica
Stenophragma thaliana
Thlaspi arvense

PERPETUAL ROSETTE PLANTS.

Adopogon virginicum
Arnoseris minima
Bellis perennis
Geum vernum
Hieracium pilosella
Houstonia coerulea
Hypochaeris glabra
Hypochaeris radicata
Lavauxia triloba
Leontodon autumnale
Leontodon hastilis
Plantago cordata
Plantago lanceolata
Plantago major
Plantago rugellii
Taraxacum erythrospermum
Taraxacum taraxacum
Tetraneuris acaulis

PERENNIAL PLANTS WHICH FORM TEMPORARY ROSETTES.

Achillea millefolium
Antennaria fallax
Antennaria neglecta
Antennaria plantaginifolia
Antennaria parlenii
Antennaria parlenii ambigens
Antennaria parlenii arnoglossa
Campanula rapunculoides
Campanula rotundifolia
Carduus arvensis
Chrysanthemum leucanthemum
Erigeron philadelphicus
Erigeron pulchellus
Geum rivale
Geum strictum
Geum virginianum
Hieracium gronovii
Hieracium scabrum
Hieracium paniculatum
Houstonia ciliolata
Houstonia longifolia
Houstonia purpurea
Houstonia tenuifolia
Lobelia kalmii
Polemonium reptans
Rumex acetosella
Samolus floribundus
Saxifraga pennsylvanica
Saxifraga virginiensis
Sedum ternatum
Senecio aureus
Senecio balsamitae
Senecio obovatus
Valeriana edulis
Valeriana panciflora
Valeriana sylvatica

Imperfect rosettes are formed by members of the following genera

Viola
Hottonia
Sarracenia
Drosera
Rumex
Osmunda
Dryopteris
Aletris
Clintonia
Spathyema
Peramium
Pyrola
Parnassia
Alisma.

MEETING OF THE BIOLOGICAL CLUB.

TOWNSHEND HALL, April 8th, 1902

The Club was called to order by the president and the minutes of the previous meeting were read and approved.

The paper of the evening was given by Prof. Cook, who described the various marine biological laboratories of the United States, and illustrated by means of lantern slides from views taken at the laboratories and in their vicinities The first laboratory of this kind was established on Penekese Island by Prof. Agassiz in 1873. It closed in 1875. Next a laboratory was opened at Annisquan, Massachusetts, by Dr. Hyatt This is supported by the Woman's Educational Society of Boston and the Boston Society of Natural History.

The marine biological laboratory at Wood's Holl was established in 1888. The first year there were nine investigators and eight students. Now the attendance is about a hundred and fifty each year The U S Fish Commission station is also located at Wood's Holl and Penekese Island is about 13 miles distant. Two other laboratories are situated on the Atlantic Coast, one at Casco Bay, Me , under the direction of Prof Kingsley, and the other at Cold Springs Harbor, Long Island. On the Pacific Coast there are two laboratories, one of which is controlled by Leland Stanford Jr. University This is at Pacific Grove, California, and was established in 1892. The University of Minnesota started a laboratory on Vancouver Island in 1901.

ORTON HALL, May 5, 1902

President Mills being absent, the meeting was called to order by the Vice-President, Mr Morse. The first paper was by Mr. Davis, and was a review of experiments performed by students in horticulture on the absorption of water by seeds Prof Hine gave notes on the life histories of some of the Tabanidae, and mentioned some means of combatting them, which have been tried with more or less success Prof. Schaffner spoke of the conjugation of Spirogyra and of the development of sex in the lower algae. The Club adjourned to meet the first Monday evening in June.

ORTON HALL, June 2, 1902

Under the head of "Personal Observations," Prof Schaffner mentioned some woody plants which he has lately found to self-prune. He also gave some notes on the anatomy of flowers of Castalia and Nymphaea. Prof. Cook explained the formation of certain bud-galls on oak which have usually been termed stem-galls. The occurrence and habits of the seventeen-year Cicada were discussed by several members of the Club.

A committee of three was appointed by the President to nominate members for the editorial staff of the OHIO NATURALIST for the coming year. The committee reported, but action on the report was deferred to an adjourned meeting to be held Thursday, June 5, at four o'clock.

F J TYLER, *Secretary.*

DONATIONS TO THE OHIO STATE UNIVERSITY.

State and General Herbariums—From Prof. Sargent, 115 specimens of woody plants. From Mr F H. Burglehaus, Toledo, Ohio, 25 specimens of fungi, 20 mosses, 25 ferns and 135 flowering plants.

Botanic Garden—From Mr Otto Hacker, Painesville, Ohio, 30 species of living plants.

Zoological Museum—Mr James Judge, Seal Islands, Alaska, an adult male specimen of the fur seal, Callorhinus alascanus, which has been mounted and is now in place in the museum

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MUSCULAR AND SKELETAL ELEMENTS OF PASSALUS CORNUTUS.

F. L. LANDACRE

The present paper on the muscular and skeletal elements of Passalus cornutus was begun with a view to determining what changes had arisen in the muscular system in connection with the burrowing habits of the animal. It was found in the course of the study that there was an almost complete atrophy of the muscles concerned in flight and a marked hypertrophy of the muscles of the legs, and that with these changes had arisen certain modifications in the hard parts to which these muscles are attached.

These changes in the hard parts were not so numerous or so radical as to justify the rather extended description of the skeleton, which had been given, if it were not for the fact that the two systems are so intimately related and the changes in the one so dependent upon those in the other that constant reference would have to be made to the skeleton. This would be confusing to a reader not entirely familiar with the hard parts.

The study of these two systems led to an investigation of the habits of the insect, especially those concerned in distribution and reproduction.

Passalus is a large black beetle of common occurrence in decaying logs and stumps which it assists materially in destroying. It can easily be identified by its large size, great strength, sluggish movements and longitudinally striated wing covers. It has a peculiar habit of stridulating when disturbed.

It can be secured in great abundance at all times of the year and is easily kept in the laboratory for observation if it is supplied with an abundance of decaying wood. Specimens for dissection should be hardened in five per cent. formalin. It is an excellent type for class work so far as its hard parts are concerned, but its muscular system is too highly modified to serve as a type for the group.

It is the only representative of its genus in America, and is quite widely distributed. Its larva is characterized by having its third pair of legs rudimentary and is supposed to have a very long larval stage.

THE EXTERNAL SKELETAL SYSTEM.

The body, as in all insects, is divided into a head, thorax, and abdomen The head contains seven segments and bears a curved spine on its median dorsal surface, and is articulated posteriorly with the prothorax This segment bears the first pair of legs and presents a smooth expanded surface dorsally It is articulated posteriorly with the meso-meta-thorax by a narrow area. This constricted area is part of the meso-thorax, which bears ventrally the second pair of legs On its dorsal surface are borne the elytra or wing covers Fused with the meso-thorax is the meta-thorax, which bears dorsally the true wings covered by the elytra and ventrally the third pair of legs. The last region of the body is the abdomen, composed of eight segments, six of which are visible ventrally, but bear no appendages

FIXED PARTS OF THE HEAD.

These are first the epicranium This term is applied in a general way to the dorsal and lateral regions of the head The portion of the epicranium lying posterior to the spine is the vertex (1) and the region lying anterior to and including the spine and extending down to a transverse depression near the anterior end of the head is the frons (2) On either side of the spine on the lateral margins of the head lie the frontal ridges (3) which mark the lateral boundaries of the frons Below the frontal ridges on the sides of the head lie the eyes (4). The epicranium extends posterior to the eye and ventral to it as the gena (5). Running back and in from the posterior ventral border of the eye is a slight elevation forming the outer wall of a groove into which the antenna fits when retracted under the head This is called the antennal groove (6). The inner border of this antennal groove is the genal ridge (7). It is a well marked elevation with its pointed anterior extremities free and it forms the outer wall of the deep genal emargination (4') into which the maxilla can be retracted. This sclerite (a small chitinized area) surrounding the foramen at the posterior surface of the head is called the occiput, but is not separated by a definite suture from the remainder of the epicranium. The clypeus (8) or epistoma lies on the dorsal surface anterior to the frons, and is separated from it by a transverse depression which does not extend completely across the head. The clypeus is called epistoma when reduced in size. The gula (9) occupies the posterior half of the median ventral portion of the head and is largely taken up with a rounded elevation which articulates with the prosternum Anterior to this elevation there is a median depression with lateral elevations. The suture which separates the gula from the sclerite lying in front of it is situated on the anterior portion of this median depression and extends laterally over the elevations on its sides It is a well marked suture and is called the gular suture (10) The submentum (11) lies in front of the gula and is separated from it by the gular suture. It is usually called the mentum, but since it is in contact with the gula it is probably the submentum It is deeply emarginated on its anterior border and free on its lateral borders The posterior portion of this free lateral border forms the inner boundary of the genal emagination into which the maxilla can be retracted. The anterior emargination is occupied by the labrum (8'9'). The compound eyes (4) lie on the sides of the head under the frontal ridges and are divided into two nearly equal portions on their anterior border by a posterior projection of the frontal ridge.

THE MOVABLE PARTS OF THE HEAD.

The antenna (2') lies just in front of the eyes under the anterior border of the frontal ridge. It has ten segments of which the first is large and concealed by the frontal ridge. The following six are almost equal in size, number 2, 3 and 4 being somewhat smaller and all are slightly elongated anteriorly The last three are much larger and prolonged anteriorly, forming a pectinate club. These three are not in contact with each other The labrum (1') lies anteriorly to the clypeus between the mandibles. It is bilobed and covered with stiff short bristles. It can be easily removed for study. The mandible (3') should be removed for examination. It is flattened laterally and examined from the under surface will be seen to bear a number of cutting spines. One of these on the ventral border near the proximal end is articulated. The maxilla (4'-7') can be removed easily for study by inserting a pin into the posterior border of the genal emargination into which the maxilla is retracted and pushing it out forward. It should be examined from the dorsal surface. It consists of a long, slender basal piece, the cardo (4'); following this is a large median piece divided longitudinally into an inner and an outer portion. The outer piece is spindle shaped and is called the stipes (5'). It bears on its anterior end a four-jointed palp (10'). On the inner border of the stipes and extending beyond its anterior end is the lacinia (6'). It bears many bristles on its free inner border and two prominent curved spines on its anterior end. On the tip of the stipes and between the palp and the lacinia is the galea (7') covered with bristles and ending in an incurved spine. It is somewhat shorter than the palp and longer than the lacinia. The labium (8'-9') lies on the median ventral surface and is attached posteriorly to the anterior margin of the submentum, and lies between the lateral projections of the submentum and under the labrum. The parts which are separate in other beetles seem to be fused in this The labium seems to be composed of mentum (8') ligula (9') and paraglossa fused. The palp is as in other forms. The proximal portion (8') probably corresponds to the mentum, the median anterior spine to the ligula (9') and the rounded lateral elevations lying on either side of the spine to the paraglossa; the palp is three-jointed.

THE PRO-THORAX

The following definitions should be kept in mind A typical body segment of an insect is composed of four main pieces or sclerites The dorsal portion is called the tergum. The side pieces are called pleura and bear spiracles when present The pleuron is divided into two smaller sclerites, the anterior or episternum and posterior or epimeron: owing to the flattening of the body dorso-ventrally in beetles the sclerites of the pleura lie on the ventral surface The ventral portion of the segment is called the sternum and is usually modified according to the size and method of articulation of the limb. The dorsal portion or tergum is also similarly modified by the attachment of the wing

The pro-notum (4-7) or pro-thoracic tergum, is a smooth rectangular sclerite covering the dorsal surface of the pro-thorax. It is divided into right and left halves by a longitudinal suture Anteriorly it ends in a sharp border, but laterally and posteriorly it is inflexed to unite with the sclerite forming the ventral wall of the body.

The prosternum (1) occupies the median ventral portion of the pro-thorax. It is compressed in the middle region between the pro-thoracic coxae and expands posteriorly into a small diamond-shaped piece Anteriorly it expands almost to the lateral border of the coxal cavities. The suture limiting the lateral area of the anterior end of the pro-sternum is V-shaped, the apex of the V pointing toward the median line. The transverse depression on the median anterior portion is not a suture but is the remnant of the fold where the articular portion of the pro-sternum was doubled under in the pupa.

The pleuron is usually composed of two sclerites, the anteriorly located episternum, the posteriorly located epimeron, and sometimes a third dorsally located epipleuron. In Passalus they are completely fused in the pro-thorax. This fused sclerite begins at the V-shaped suture mentioned as forming the lateral boundary of the anterior portion of the prosternum and extends around the coxal cavity and forms a suture with the posterior portion of the sternum. The region in front of the coxal cavity probably corresponds to episternum (2); that behind the coxal cavity to the epimeron (3), and that lateral to the coxal cavity and fused with the pro-notum to the epipleuron. Its anterior and posterior boundaries are free; its lateral fused with the pro-notum and its median forms the lateral and posterior wall of the coxal cavity and unites by a suture with the anterior and posterior portions of the sternum. The fused condition of these parts is probably related to the burrowing habit of the beetle, the solid piece giving greater strength both in forming an attachment for muscles and articulations for the fore-legs

The pro-thoracic leg consists of the usual number of segments They are named as follows, beginning at the body or proximal end. coxa, trochanter, femur, tibia, and tarsus The coxa (8) is the very large sclerite placed transversely in the coxal cavity and reaching three-fourths of the distance from the median line to the lateral border of the pro-thorax. It can be rotated forward and backward on its long axis It is articulated on the median extremity with the large femur (10) and the small trochanter (9) lying on its anterior proximal surface The coxa sends a small projection between these parts on the ventral surface resembling a ball-and-socket joint, and on the dorsal surface sends forward a broad flat piece Between these ventral and dorsal pieces the femur and its fused trochanter articulate.

The trochanter (9) is a small segment lying on the anterior surface of the proximal end of the femur It is about one-fourth the length of the femur.

The femur (10) is the largest segment of the leg and is flattened dorso-ventrally On the anterior border of the distal portion there is a cavity into which the tibial spur fits when the tibia is flexed. The dorsal surface of the dorsal wall of this depression bears a bundle of bristles in a slight depression just back of the distal extremity. This distal wall of the depression serves as a brace against which the tibial spine works. The tibia (11) is nearly as long as the femur and is flattened also dorso-ventrally. On its posterior border it bears eight blunt spines, and on its anterior border a single articulated spine near the distal end called the tibial spine. There is a circlet of bristles around the base of the spine.

The tarsus (12) consists of five segments of which the first and third are the longest; the remaining three small and similar in shape; the fifth bears a pair of claws, two short bristles are borne between the claws, and also a prolongation of the last segment called the pulvillus. The tibial joint opens forward in the first pair of legs and backward in the second and third pairs. The trochanter lies on the anterior surface of the first pair, but on the posterior surface of the last two pairs. By comparing this leg with the last two it will be seen to be rotated forward, that is, structures on the posterior surface of the first leg are on the anterior surface of the last two pairs.

The trochantin is situated on the outer end of the coxa It is convex and presents three faces, an outer or lateral, which is smooth, an inner or dorsal, which furnishes attachment for the dorsal muscles, and a ventral face, which furnishes attachment for the ventral muscles. It is articulated by its posterior border with the coxa and lies in a depression of the anterior arm of the coxa below and in front of the point of articulation of the coxa with the body wall

The jugular sclerites (13) are small pieces lying between the posterior ventral portions of the head and the anterior portion of the pro-thorax The anterior surface is concave and smooth It articulates with the head and is attached to it on its ventral inner border by a strong ligament. The ventral portion of the posterior surface is smooth and protrudes from under the pro-thoracic sternum The dorsal two-thirds of the posterior surface is rough and bears a posteriorly directed process which gives off a ventral keel and a lateral one which runs to near the inner border.

The meso-thoracic spiracle lies on the hinder border of the coxa in the membrane connecting the coxa to the posterior border of the pro-sternum and epimeron It is not visible from the exterior but can be seen by removing the coxa It is very large, being about four millimeters in length.

THE MESO THORAX

This segment articulates anteriorly with the pro-thorax and is fused posteriorly with the meta-thorax. It is much narrower than either of these segments and bears on its dorsal surface a strongly chitinized elytra or wing cover, and on its ventral surface the second pair of walking legs The meso-thoracic tergum of some beetles contains four sclerites, the prescutum, scutum, scutellum, and postscutellum. The prescutum and postscutellum are frequently wanting.

The scutellum (6) lies on the mid-dorsal line of the meso-thorax. It is triangular with the base of the triangle directed forward It is free in front, and laterally is continued under the triangular base of the elytra in a less chitinized area which finally is continuous with the articular membrane of the elytron. Posteriorly it is fused with the postscutellum. The postscutellum (7) is a long rod-like sclerite and is fused with the posterior border of the scutellum by which it is partly concealed. From the posterior apex of the scutellum it extends laterally and anteriorly. Its total length is about equal to the scutellum. Its lateral extremity articulates with the metathoracic prescutum.

The scutum is not well defined in Passalus and seems to be divided into two portions, which are located on the anterior and lateral extremities of the scutellum. These small pieces are elongated and inflexed anteriorly, and laterally, come into contact with the episternum. Posteriorly they pass into the articular membrane of the elytra

The elytra (15) are articulated to the body by a triangular base which fits between the scutellum and episternum. In studying the elytron it should be extended at right angles to the body as in flight. When thus extended there can be seen in the articular membrane which connects the inner surface of the basal triangle with the body a small sclerite called the paraptara (14). The elytron bears ten longitudinal grooves and is inflexed slightly on the lateral margin to form the epipleuron. The inner margins are bevelled so that the edges fit closely when the wing covers are at rest. There is in addition to this a clasp which fits in between the lateral margins of the scutellum and the postscutellum This clasp lies on the inner border of the triangular base of the elytron and can be demonstrated by slowly separating the wing covers and observing the manner in which the clasp slips from under the edge of the scutellum.

The mesothoracic sternum (1) lies on the median ventral portion of the mesothorax anterior to the mesothoracic leg and is kite-shaped. It is truncated at the anterior end and on its anterior lateral border is in contact with the episternum (2). Its lateral tip touches the epimeron and its hinder border is in contact with the meta thoracic epimeron and the coxal cavities It ends posteriorly in a narrow neck between the coxal cavities Just in front of the outer half of the coxal cavity is a crescent-shaped area separated from the sternum by a slight depression.

The episternum (2) forms the side wall of the constricted region of the meso-thorax. It is triangular in shape, its base being anterior and free. On its ventral surface it is in contact with the sternum. On its dorsal surface it is in contact in front with the articular region of the elytron and posteriorly with the small epimeron (3) throughout about half of its length.

The epimeron (3) is a small sclerite lying at the posterior angle of the episternum and is visible at the anterior ventral border of the wing cover when it is closed. It is roughly triangular with the apex directed up and forward. It is in contact anteriorly throughout its whole length with the episternum, ventrally with the sternum, posteriorly with the metathoracic sternum and episternum and dorsally with the metathoracic scutum.

The coxa (8) of the mesothoracic leg appears globular on its surface, but is really as long as the prothoracic coxa, as will be seen by examining its internal surface. The coxal cavity is much smaller, however, and not circular. The coxa is dovetailed between the trochanter and femur on the ventral surface and articulates over them on the dorsal surface.

The trochanter (9) is fused to the posterior surface of the femur at its proximal end The femur (10) is flattened dorsoventrally and hollowed on its posterior surface from the distal end of the trochanter to the tibial joint. The mesothoracic tibia (11) bears no spine at its proximal end The articulation should be examined from the inner surface. On its dorsal surface it bears a dense row of bristles and at its articulation with the tarsus, four spines, two ventral and two lateral. The tarsus (12) resembles the prothoracic tarsus closely, having first and last segments long and the intermediate ones short

By comparing the mesothoracic legs with the prothoracic these latter will be seen to be rotated through 90 degrees on their coxae so that posterior, anterior, dorsal and ventral are reversed.

The metathoracic spiracle is situated on the hinder and upper border of the epimeron in the membrane connecting this sclerite with the wing articulations It is usually tucked under the border of the epimeron.

THE META-THORAX.

The metathoracic sternum (1) forms the floor of this segment between the second and third pairs of legs Anteriorly it begins on the median line by a narow neck extending between the meso-coxae The anterior boundary then curves around in front of the coxal cavity and comes into contact with the meso-sternum and ends antero-laterally in contact with the meso-thoracic epimeron. Beginning with the hinder border of the coxal cavity and extending to the epimeron is a shallow groove marking off a narrow strip from the anterior border to this sclerite. This is usually described as the mesothoracic epimeron, but is attached to the meta-sternum and cannot be separated from it. The lateral boundaries of the meta-thoracic sternum are straight and begin at the mesothoracic epimeron and end at the metathoracic coxal cavities. The lateral border bears a shallow groove and the outer elevated wall of this groove is in contact with the metathoracic episternum (2) throughout its whole length. Posteriorly the metasternum forms the anterior boundary of the metathoracic coxal cavity.

The metathoracic episternum (2) is a long, narrow sclerite lying on the lateral border of the sternum from which it is separated by a sharply defined groove except at the posterior end. At this point it is fused with both the sternum and epimeron to form the lateral articulation for the metathoracic coxa. Anteriorly it gives off a dorsal process which forms part of the wing articulation and lies between similar processes on the scutum (5) and epimeron (3). On its dorsal surface it is in contact throughout its whole length with the epimeron The suture separating the episternum from the epimeron is best seen on the dorsal process and on the anterior half of the dorsal surface. Its boundaries are ventrally the sternum, anteriorly the scutum, and dorsally the epimeron.

The epimeron (3) is a somewhat ill-defined sclerite lying dorsally to the episternum with which it is in contract throughout its whole ventral border. It consists of a strong narrow, chitinized bar with an anterior dorsal process which with similar processes from the episternum and the scutum form the ventral articulation for the wing This sclerite can be easily separated from the episternum on its anterior half Its posterior half is fused with the episternum. The dorsal boundaries of this sclerite are less definite. The anterior half bears a large, slightly chitinized triangular area, the posterior end of which articulates with a lateral process from the postscutellum. Excepting this triangular area the dorsal boundaries of this sclerite seem to be membraneous

The first abdominal spiracle (25) lies above the posterior border of the epimeron in a membranous area and is over two millimeters in length It is placed in a slightly more oblique position than the mesothoracic spiracle, and its hinder border lies directly under the second abdominal spiracle

The metanotum (4-7) forms the dorsal wall of the metathorax extending from between the wings as far back as the first segment of the abdomen. It is variously marked with chitinized bars and membranous areas so that the boundaries of its separate sclerites are hard to locate. In attempting to determine these dry specimens should be used to determine the sutures and moist ones to determine the articulations. The prescutum (4) lies just back of the meso-scutellum, its median rod-like portion being concealed by the meso-scutellum. It is dumb-bell-shaped and its enlarged ends form part of the anterior squarish end of the metanotum. It extends on either side of the median line to points even with the lateral edges of the meso-scutellum. It is bounded posteriorly by the chitinized bar extending across the body between the articulation of the wings. The scutum (5) is a small sclerite lying directly beneath and in front of the articulation of the wings. Its ventral border rests on the meso-epimeron (3). Its posterior border rests on the anterior bar of the met-episternum (2): dorsally it assists in forming an articulation for the wing, and on the median border is connected with an articular cartilage. On its anterior face it bears a circular depression limited internally by a drum-like membrane. In the body this drum-like membrane is borne on the small end of a funnel-shaped piece whose large end extends freely into the body cavity. This cone furnishes attachment for muscles Between this sclerite and the end of the prescutum lies a circular chitinized area. The scutellum (6) is a large sclerite forming the greater part of the dorsal surface of the metathorax. It is limited in front by a chitinized bar extending between the articulation of the wings and forming the squarish front to the metanotum Laterally it is bounded by a membrane lying below and behind the articulation of the wing with the dorsal surface of the epimeron The postscutellum (7) is not well separated from the scutellum except at its lateral margins Posteriorly the scutellum is fused with the postscutellum

The boundaries of the postscutellum (7) are very difficult to make out In the median line it is a very narrow bar lying between the posterior ends of the median rectangular area of the scutellum This narrow bar fades out as it passes to the side of the body, but again becomes chitinized and enlarging forms an articulation with the median dorsally projecting bar of the episternum Its boundaries are posteriorly the thin membrane of the first abdominal segment, laterally the meta-sternum, and anteriorly it is fused with the scutellum

On the posterior border is a thin membrane stretching from the second abdominal spiracle of one side to that of the other It is about as broad as an abdominal tergum and probably belongs to the first abdominal segment It appears to be simply a broadened articular membrane, but may include a portion of the postscutellum.

THE WING

The articular membranes at the base of the wings bear several small sclerites which can be located more easily after the wing veins have been described In identifying the wing veins the wings should be extended at right angles to the body. The margin which lies anteriorly when the wing is extended is called the anterior margin and the hinder border the posterior or anal margin. The homology of the wing veins is somewhat doubtful and the transverse folding of the hinder third of the wing in beetles to enable the wing to be withdrawn under the elytron renders the identification of the small veins in that region still more difficult.

The costa (13) is a short vein lying on the anterior proximal border o[illegible]e wing and is nowhere completely separate from the vein lying next to it except for a short distance at about one-fourth the distance from the proximal end of the wing to the tip. Here there is a spindle-shaped area where the veins are separate The proximal portion of this vein is connected by a transverse chitinized bar with the next vein, and from this point is continued as a strongly chitinized bar to the end of which the articular membrane lying in front of the wing is attached.

The subcosta (14) lies just posterior to the costa and is closely fused to it except at the point mentioned above and also at the proximal end where after fusing with the transverse bar connecting it with the costa it projects toward the median line and articulates with a large movable sclerite The fused costa and subcosta can be traced as far as a transverse articulation of the outer third of the wing

The radius (15) is a large vein lying posterior to the subcosta and extending from the base of the wing to the transverse articulation At its proximal end it is interrupted by an oval membranous area over which it extends as a narrow bar, and beyond this enlarges and fuses with the enlarged end of the subcosta It also sends posteriorly a small process which articulates with one of the free sclerites Distally beyond the tranverse articulation of the wing these veins are continued as a broad slightly chitinized area. Just posterior to this broad area which forms the anterior margin of the outer third of the wing is a short vein extending from the articulation of the wing It is the posterior division of the radius

The next three veins arise together from an irregular plate formed by the fused and enlarged ends of the veins The plate articulates with the movable sclerite by a well defined process extending between two non-chitinized areas. The media (16) is the most anterior and the largest of the three At its base it is in contact on its anterior border with the radius. Distally it separates from the radius and at the transverse articulation turns posteriorly and reaches the margin of the wing There is a second short vein lying anterior to the distal end of the medius and reaching from the transverse articulation to the tip of the wing. This is media No. 1, the main vein beyond the articulation being media No 2. Posterior to the main branch of the media and within the transverse articulation is a small vein which is probably media No. 3. It does not come quite into contact with the media but arises near it.

The cubitus (17) is the second of this group and arises posterior to the medius and is in contact with it for some distance after which it turns by a gentle curve to the anal margin of the wing. It forms a large triangle in which the third division of the media lies.

The third (18) and most posterior vein arising from this plate is the first division of the anal vein. It is not in contact with the cubitus after leaving the plate but bending forward comes almost into contact and then turns sharply to the anal margin of the wing The second (18) and third (18) divisions of the anal veins are separated from the first by the articulation by which the anal margin of the wing is doubled under when the wing is at rest. There are two of these the anterior being a well defined vein while the posterior is simply a broad chitinized area The bases of these veins articulate with one of the movable sclerites at the base of the wing

THE DETACHED SCLERITES AT THE BASE OF THE WING

The most prominent of these detached sclerites is a strongly chitinized V shaped (19) piece which is directed in [illegible] forward The base of the V articulates with the antero-lateral edge of the scutellum The anterior arm of the vein articulates at its extremity with the end of the subcostal vein The posterior arm articulates by its anterior border and its extremity with a large irregular slightly chitinized sclerite to be described next This V shaped sclerite consists of a narrow piece projecting from the lateral chitinized border of the scutum and scutellum In moving the wing the V rolls foward and over the spine so that if the spine is depressed and the V is pulled as described the wing is elevated

The second large sclerite (20) lies between the posterior arm of the first and the end of the wing veins The anterior half which articulates with the posterior arm of the first is depressed below the level of the posterior half which articulates with the anal vein The anterior depressed portion articulates with the projection from the plate which serves as the origin for the media and cubitus

A third small sclerite (21) lies in the membrane just posterior to the posterior arm of the V shaped sclerite It is well chitinized and triangular in shape

There is a fourth sclerite (22) lying ventral to the base of the wing in the membrane which connects the base of the wing with the dorsal surface of the epimeron It is oval and slightly chitinized

A fifth sclerite (23) similar in shape to the fourth lies just anterior to the base of the wing in the triangular membrane lying under the outer border of the metathoracic scutellum

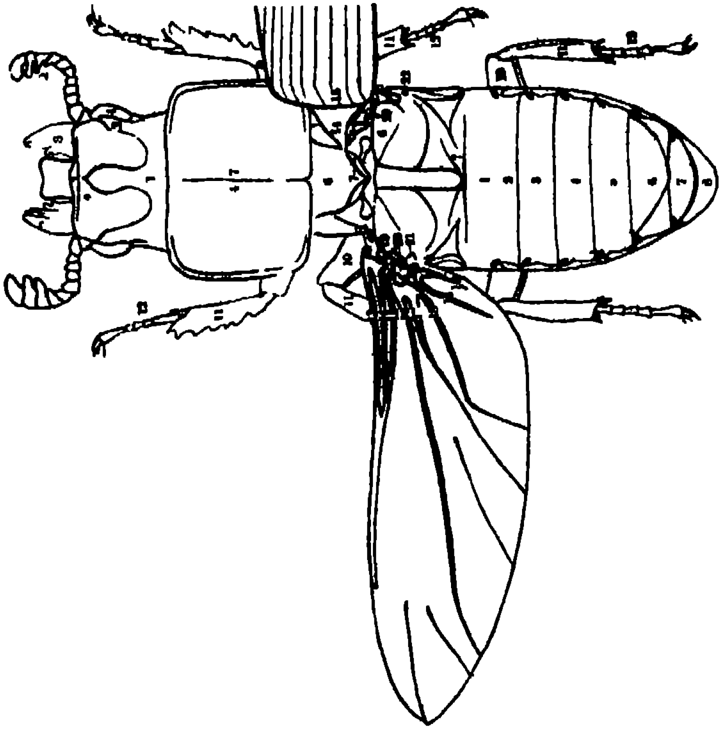
THE ABDOMEN

There are seven sterna (1 7) in the abdomen six of which are visible The first (2) can be seen at the outer angle of the metathoracic coxal cavity as a small triangle but if the coxa be removed it will be seen to extend across the body as a narrow bar and to unite in the middle line in a slight elevation between the inner ends of the coxa. It is separated on the median line from the second sternum by a decided notch The second sternum is indented by the coxa and presents a median elevation between the coxae which is visible on the surface. The median elevation on the first segment cannot be seen from the surface. The second and third sterna articulate; the remainder are imovably fused. The third, fourth, fifth and sixth sterna are fused and, like the first and second, are inflexed at the sides of the body and end in a well-defined suture just beyond the point of inflexion except the surface The seventh sternum is not visible on the ventral surface of the body, but can be seen on the posterior end of the body forming the ventral wall of the anal opening. It is crescent-shaped and bears a number of short hairs. It cannot be divided into sternum and tergum

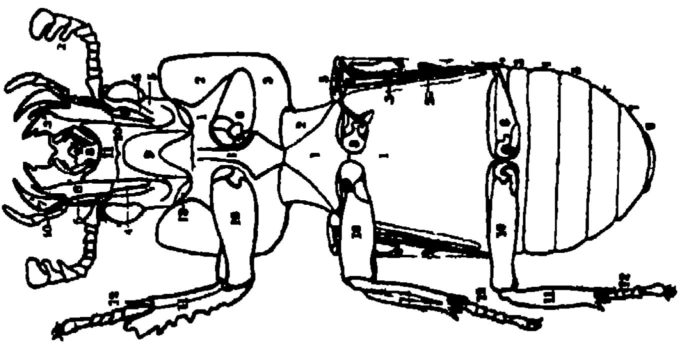
There are seven pleura corresponding to the seven sterna The first six are distinctly separated from the sterna by a well defined longitudinal suture. The seventh is fused with its sternum to form the ventral wall of the anal opening Each sternum is fused to its corresponding tergum.

The abdominal spiracles are situated on the dorsal anterior borders of their respective pleura, excepting the second, which lies anterior to its pleuron and directly over the end of the large first abdominal spiracle. The first abdominal spiracle is the large one described in connection with the meta-thorax. The seventh spiracle is much reduced in size and difficult to see from the surface.

There are seven abdominal terga (2'-7') corresponding to the seven pleura, but there are eight in all. The first is the broad membrane lying in contact with the metathoracic postscutellum. The second, third, fourth and fifth are similar and membranous. The sixth, seventh and eighth are chitinized more or less, and the seventh is called the propygidium, and the eighth the pygidium. The eighth forms the dorsal wall of the anal opening.



Dorsal



Ventral

LANDACRE ON PASSALUS

Explanation of Plates.

The Head

1 Vertex
2 Frons
3 Frontal ridges
4 Eyes
5 Gena
6 Antennal groove
7 Genal ridge
(4') Genal emargination containing cardo
(8) Clypeus
9 Gula
10 Gular suture
11 Sub-mentum

1' Labrum
2' Antenna
3' Mandible
4' Cardo
5' Stipes
6' Lacinia
7' Galea
8' Mentum
9' Ligula
10' Palp

The Prothorax

1 Prosternum
2 Episternum
3 Epimeron
4-7 Pronotum
8 Coxa
9 Trochanter
10 Femur
11 Tibia
12 Tarsus
13 Jugular sclerites

The Mesothorax

1 Mesosternum
2 Episternum
3 Epimeron
4-5 Apparently absent
6 Scutellum
7 Postscutellum
8 Coxa
9 Trochanter
10 Femur
11 Tibia
12 Tarsus
13 Not represented
14 Paraptera
15 Elytra

The Metathorax

1 Sternum
2 Episternum
3 Epimeron
4-7 Metanotum
4 Prescutum
5 Scutum
6 Scutellum
7 Postscutellum
8-12 Metathoracic Leg
13 Costa
14 Subcosta
15 Radius
16 Media
17 Cubitus
18 Anal
19-23 Detached sclerites

25 First Abdominal Spiracle

The Abdomen

1-7 Abdominal Sterna
1'-8' Abdominal terga

OHIO PLANTS WITH DISSECTED LEAVES.

HARRIET G. BURR.

An ordinary plant is dependent upon light for its nutrition; and, since the leaf is the organ in which the food is mainly manufactured, it follows that the leaves are arranged in such a way as to give them as much light as possible without causing injury to their structure. Under ordinary circumstances they have an expanded blade which presents a large amount of surface in proportion to the mass Whenever this is not the case we look for something in the environment to explain the departure from the usual condition.

There are plants which, typically, have leaves of a certain form, but which, when grown in a different situation, produce leaves of an entirely different character Plants which grow in very dry regions and also in moister regions have a typical form of leaf for each condition The same is true of those plants which grow sometimes submerged in water and sometimes on dry land. In the case of many plants which grow with a part submerged and a part above water, each will have its own form of leaf Submerged plants invariably produce the most finely dissected leaves, plants which grow in crowded or in very dry situations also usually produce much-divided leaves.

Below are shown lists of the more typical Ohio plants which have leaves of this kind The first list comprises those which grow in water; the second, those which grow in dry land, whether in dry or moist soil

One of the most striking of the water plants is *Bidens Beckii* or Water Marigold. The submerged leaves are very finely dissected, the plant blooms above water, and the upper leaves are above water; all these latter leaves are simple and undivided. The second list is necessarily more heterogeneous than the first, including plants found in moist, rich woods, in waste places, and on roadsides, in dry, hot situations, and so forth

The cause ordinarily given for the dissected leaf under these conditions is the adaptation to secure as much light as possible for those which grow in crowded situations, and to reduce transpiration as much as possible for those in dry conditions. Where plants are crowded together, as they are sometimes along our roadsides, a simple entire leaf would shade those beneath it, whereas compound and dissected leaves allow the light to sift through them and so reach those below.

Finely dissected leaves are much better adapted to a water medium than leaves with undivided or with large blades would be, and it is this adaptation, together with the response to diminished light, differences in nutrition, temperature, and so forth, which is the commonly accepted explanation for the form of submerged leaves. This explanation, however, is too general to be entirely satisfactory. In this connection, McCallum* has been conducting experiment with *Proserpinaca palustris*, at the Hull Botanical Laboratory. These experiments seem to indicate that the heretofore accepted explanation based upon diminished light, nutrition, and so forth, will not hold good. It appears that the only constant factor in all cases where the water form develops is the checking of transpiration and the increased amount of water in the protoplasm. Whatever the inciting cause may be, it seems that this condition brings out a certain set of hereditary characters while the absence of it produces a different set; just as a root in the soil is a typical root, but when growing above the ground may sometimes produce buds and leaves

IN WATER.

Ceratophyllum demersum—in ponds and slow streams.
Ranunculus delphinifolius—in ponds.
Batrachium tricophyllum—in ponds and streams
Batrachium divaricatum—in streams.
Roripa Americana—in lakes and slow streams.
Podostemon ceratophyllum—in shallow streams.
Floerkea proserpinacoides—in marshes and along rivers
Proserpinaca palustris—in swamps
Myriophyllum spicatum—in deep water
Myriophyllum verticillatum—in both deep and shallow water.
Myriophyllum tenellum—on sandy bottoms of ponds and streams.
Myriophyllum heterophyllum—in ponds
Conioselinum Chinense—in cold swamps
Hottonia inflata—in shallow stagnant ponds
Utricularia vulgaris—in brooks and ponds.
Utricularia intermedia—in shallow water along margins of pools and ponds.
Utricularia minor—in shallow ponds and bogs
Utricularia gibba—in shallow water or in mud on borders of ponds and pools.
Bidens Beckii—in ponds and streams.

ON DRY LAND.

Delphinium consolida—in waste places.
Delphinium Carolinianum—on prairies and open grounds.
Bicucalla cucullaria—in woods.
Bicucalla Canadensis—in rich woods.
Capnoides flavulum—in rocky woods.

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*W. B McCallum. On the Nature of the Stimulus causing the Change of Form and Structure in *Proserpinaca palustris* Bot Gaz 34 93-108, 1902

Fumaria officinalis—in waste places and on ballast.
Sophia pinnata—in dry soil.
Potentilla argentea—in dry soil.
Kuhnistera purpurea—on prairies
Geranium columbinum—in fields and along road-sides.
Geranium dissectum—in waste places.
Erodium cicutarium—in waste places and fields.
Viola pedatifida—on prairies.
Viola pedata—in dry fields and on hillsides
Daucus carota—in fields and waste places
Caucalis anthriscus—in waste places.
Foeniculum foeniculum—in waste places
Eulophus Americanus—in dry soil.
Chaerophyllum procumbens—in moist ground.
Carum carui—occasionally in waste places
Ptilimnium capillacea—in wet soil.
Erigenia bulbosa—in woods
Quamoclit quamoclit—in waste and cultivated ground.
Conobea multifida—along streams and rivers
Ambrosia artemisiaefolia—in dry soil
Coreopsis tinctoria—in moist soil
Coreopsis verticillata—in dry soil
Dysodia papposa—along streams and roadsides
Achillea millefolium—in various situations.
Anthemis cotula—in fields, waste places and along roadsides
Anthemis arvensis - in fields and waste places.
Matricaria inodora—in waste places
Matricaria chamomilla—in wast places and on ballast.
Matricaria matricaroides—in waste places, on ballast, and along railroads
Tanacetum vulgare - along roadsides
Artemisia caudata—in dry sandy soil
Artemisia canadensis—in rocky soil
Artemisia abrotanum—in waste places.
Artemisia annua—in waste places

ALGAE FROM SANDUSKY BAY.

Lumina C. Riddle.

During a six weeks stay at the Lake Laboratory the writer kept a careful list of all the algae found in water from Sandusky Bay and vicinity. Those not found in the Bay have the name of the locality following that of the plant. Those names not included in Dr. Kellerman's preliminary check lis of Ohio Algae, in The Naturalist nor in "The Plants of Western Lake Erie" by A. J. Pieters are marked by the letter n. The nomenclature is that used in De Toni-Sylloge Algarum.

Chroococcaceae

Coelosphaerium kuetzengeanum Naeg n
Merismopedia glauca (Ehrenb) Naeg n
" convoluta Breb n

Oscillatoriaceae.

Arthrospira jenneri (Hassel) Stiz n

Nostocaceae

Aphanizomenon flos-aquae (L.) Ralfs n

Beggiatoaceae

Beggiatoa alba (Vaucher) Trevisson. n

Pleurococcaceae

Dimorphococcus cordatus Wolle n.
Rhaphidium polymorphum Fresen
" aciculare (A Br) Rabenh n
" falcatum (Corda) Rabenh n
" convolutum (Corda) Rabenh. n.
Staurogenia cruciata Wolle n
Scenedesmus bijugatus (Turp) Kuetz. n.
(*S obtusus.*)
" quadracauda (Turp) Breb
" obliquus (Turp) Kuetz n
(*S. demorphus*)
Tetraedron trigonum minus Reinsh n
(*Polyedrium*)
" " bifurcatum Wolle n
" tetragonum (Naeg) Hansg. n.
" minimum (A Br) Hansg n.
" enorme (Ralfs) Hansg. n

Sorastraceae

Coelastrum microporum Naeg. n.
" cambricum, Archer n.
Sorastrum spinulosum Naeg. n.

Hydrodictyaceae.

Pedeastrum boryanum (Turp) Menegh.
" duplex Meyen.
(*P. pertusum*)
" tetras (Ehrenb) Ralfs.
(*P. ehrenbergii*)
Hydrodictyon reticulatum (L) Lagerh.

Desmidaceae.

Closterium strigosum Breb. n.
" lunula (Muell) Nitzsch. n.
" cucumis Ehrenb. n.
" acuminatum Kuetz. n
" leibleinii elatius Lewen
Pleurotaenium trabecula (Ehrenb) Naeg
(*Docidium*)
Disphinctum notabile (Breb) Hansg. n.
(*Cosmarium.*)
Cosmarium leve septentrionalis Wille n.
" contractum Kirchn
" granatum Breb.
" orbiculatum Ralfs.
" margaretiferum (Turp) Menegh
" botrytes (Bory) Menegh
" portianum Archer
" intermedium Delp.
" suborbiculare Wood n.
" coelatum Ralfs. n.
" subcrenatum Hantzsch. n
" blytii Wille n.
" biretum floridense Wolle n
" ornatum Ralfs
" broomei Thwaites
" pardalis Cohn. n.
Euastrum elegans (Breb) Kuetz
Staurastrum muticum depressum (Naeg) Boldt n
(*S. muticum minus*)
" aversum Lund. n.
(*S. brevispina*)
" polymorphum Breb.
" pentacladium Wolle. n.
" aspinosum Wolle. n.
" grallatorium Nordst. n.
Desmidium aptogonium (Kuetz) Lagerh.
Hyalotheca dessiliens (Smith) Breb.

Volvocaceae.

Gloeocystis gigas (Kuetz) Lagerh.
(*Protococcus.*)
Haematococcus lacustris Girod.
(*Sphaerella pluviales.*)
Spondylomorum quaternarium Ehrenb n.
Pandorina morum (Muell) Bory.
Eudorina elegans Ehrenb. n.
Volvox globator (L) Ehrenb.

Cladophoraceae.

Cladophora declinata fluitans (Kuetz) Hansg. n. Castalia

Ulothrichaceae.

Microspora vulgaris farlowii Wolle n Castalia.
(*Conferva*)
" fugacissima (Roth) Rabenh n

Oedogoniaceae

Bulbochaete rhadinospora Wittr. n

Helminthocladiaceae

Chantransia pygmaea Kuetz Castalia.

THE MAXIMUM HEIGHT OF PLANTS IV.

JOHN H SCHAFFNER

During the past summer a few measurements on the height of various plants were taken and those which are considerably above the size given in our manuals are recorded below All of the plants in the list are from central and western Kansas, except three, which were measured in Ohio

Syntherisma sanguinalis (L) Dull.	5	feet
Panicum capillare L	5½	"
Panicum proliferum Lam	5¼	"
Chaetochloa viridis (L) Scrib.	5⅓	"
Bouteloua oligostachya (Nutt) Torr.	2⅔	"
Atheropogon curtipendulus (Mx.) Fourn	4⅓	"
Eragrostis major Host	4	"
Viola rafinesquii Greene—Ohio,	1¼	"
Teucrium canadense L.	3½	"
Salvia lanceolata Willd	4	"
Solanum nigrum L.	5	"
Solanum rostratum Dunal	4	"
Linaria linaria (L) Karst , Ohio,	4½	"
Iva xanthiifolia (Fres) Nutt	13	"
Xanthium speciosum Kear.	8	"
Boebera papposa (Vent) Rydb.	2¼	"
Erechtites hieracifolia (L.) Raf., Ohio,	10½	"

*ON A VISUAL AREA IN LAMPSIDA VENTRICOSUS

F L LANDACRE.

The following observations were made on *Lampsida Ventricosus* (*Unio subovatus*), with a view to determining the exact nature of what appears to be a visual area on the posterior mantle lobe

This particular clam attracted the writer's notice during several years while collecting material for laboratory use The females while carrying the young glochidia, in the fall, frequent the ripples rather than the quiet portions of the stream, as most clams do and always lie in the gravel with the long axis horizontal In addition to these two peculiarities, ventricosus almost always has two large frill like appendages on the hinder edge of the mantle lobe, and these are usually found moving in the running water These frills are from one inch to an inch and a half long, and bear a prominent eye like spot on the dorsal portion The frill is widest on the ventral portion and gradually merges into the mantle on its dorsal surface The free edge of this frill bears tentacles which are well pigmented

The dark spot on the dorsal portion is borne on a light field

The waving of the frill, which at first appears to be due to the current, was found, after specimens were kept under observation in the laboratory, to be quite regular in quiet water, and to occur at the rate of from thirty to fifty contractions per minute.

The purpose of these movements seems to be to furnish fresh water to the young in the gills These are frequently so distended with young that the clam cannot close its shell at all. It can hardly serve the purpose of distributing the young as they are carried until spring

The animal, while moving its mantel lobes in the water, bears a striking resemblance to a bit of grass attached to a half submerged stone. This protective resemblance can hardly account for the peculiarity, and, as suggested above, it is probably respiratory in function

The animal is much more active on bright days, and was observed to retract its mantle when a shadow was thrown on it. This suggested that there must be a visual epithelum somewhere on the mantle lobe.

The attempt to demonstrate the connection of the nerves running to the posterior mantle region with the epithelial cells was not successful, although both Golgi, and Vom Rath methods were used. The histology of the pigmented area, especially the eye like spot was carefully worked out, and while the actual contact between nerve and epithelial cell would be needed for a demonstration, this spot has every appearance of being visual and the writer believes it to be such

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* Read before the Ohio Academy of Science, Columbus, Ohio, 1897

The mantle was found by repeated experiment to be sensitive to both concentrated rays of light and to shadows. It was not determined whether the visual area was confined to one spot or generally distributed.

A section through the eye like spot shows the epithlium to be greatly thickened, and much more pigmented than the ordinary epithelial cells. The slightly pigmented epithelium is about 15 micromillimeters thick while the eye spot is 60

The ordinary epithelium is pigmented throughout about half its length, the remaining basal portion of the cell being taken up with the nucleus, while in the visual cell the nucleus is 15 mm. long and the pigmented area 45 mm. long

The outer exposed end of the visual cell bears a well marked corneous like coat while this is almost absent from the surrounding epithelium.

In addition to these marked differentiations, the basal ends of the visual cells are drawn out into branched processes which are about 15 mm. long. These extend down into the subjacent tissue and supply the place of a rather well defined membrane which exists between the ordinary epithelime and underlying tissue. While these processes have not been proven to be in contact with nerves, yet there is an undoubted visual area here The modification of the ordinary epithelium into a heavily pigmented epithelium and this finally into a visual area as in this form does not involve nearly so radical a change as has gone on in the develepement ,of the pallial eyes of *pecten*. The corneous lens like body is only a modified cuticle and any cell bearing pigment may be sensitive to light

The presence of so well defined visual area in one of our fresh water clam is a striking fact since the group as a whole seems to be entirely insensitive to light.

MEETING OF THE BIOLOGICAL CLUB.

The Biological Club met in Orton Hall, Oct. 5; the program consisted of reports of work done by the different members during the summer.

Mr. Mills reported that the Baum Village was divided into clans and stated that copper, obsidian and pottery had been discovered in the mound. Explorations at Kinnickinnick showed that the implements etc used were the same as those in the Hopewell collection. The structure of this mound is somewhat peculiar: at its base is a low platform of hard tamped clay and below this is an older village site. He also reported the discovery of the skull and lower jaw of a mastadon at Grove City. They were imbedded in boulder clay about 9 feet below the surface.

Prof. Osborne reported an increased attendance at the Lake Laboratory. His work was especially with the Hemiptero. He reported that the attendance at the Zoological Section of the A. A. A. S. was large and the papers good. He mentioned especially some on the cicada which showed that it took food in its adult state and that there are according to measurements of specimens several distinct species previously supposed to be varieties.

Prof. Prosser reported work on the Columbus quadrangle of the Topographical survey which showed some very interesting features and gave the results of some of his work on the correlation of various formations

Prof. Schaffner reported Elymus hirsutiglumis as new to the state list and gave some notes and photographs of the Ecology of the prairies, showing strikingly the effect of water

Miss Riddle reported finding some of the more unusual flowering plants at Sandusky and collecting numerous algae from the bay.

Dr Killerman reported three weeks of very profitable collecting along the Greenbrier River in south-eastern West Virginia. He stated that his results were not ready for a full report as yet.

Mr. Griggs gave some account of a trip to Guatumala, emphasising the opportunities for investigation of tropical forms and the relative ease with which one could take advantage of them.

A committee consisting of Prof Osborne, Prof. Killerman and Miss Flynn was appointed to nominate officers for the ensuing year.

OTTO E. JENNINGS,
Secretary, pro tem.

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A STATISTICAL STUDY OF VARIATIONS IN THE PERIODICAL CICADA.*

HERBERT OSBORN

One principal variation from the normal type of *Tibicen septemdecem* has been recognized at least since 1829 It was described as a distinct species in 1857, but later Riley† and other authors have given it varietal rank only, and Marlatt in 1898‡ terms it a "dimorphic variety."

In the occurrence of the present year this form has been very abundant at Columbus and elsewhere, and I have thought it might be worth while to secure some statistical data as to it and to review briefly the question of its relation to the typical form.

Material has been collected from the University grounds and timber near by, from Arlington to the west and Franklin Park to the east of the city, representing points about eight miles apart, and other lots in Cincinnati and at Brush Lake. Observations have been reported to me by Mr. Dury and Professor Geyer, of Cincinnati, and from Prof Cook, of DePauw University, Greencastle, Ind. These specimens and observations have been corroborative of my own and need not be further mentioned, except when included with precise measurements.

The *cassini* form is smaller than the normal and the abdomen beneath is entirely black, only rare specimens showing a narrow hind border of yellowish or orange yellow. The cross veins of the wing forming the "W" mark are commonly less oblique and the "W" therefore shortened. This point, however, as in the

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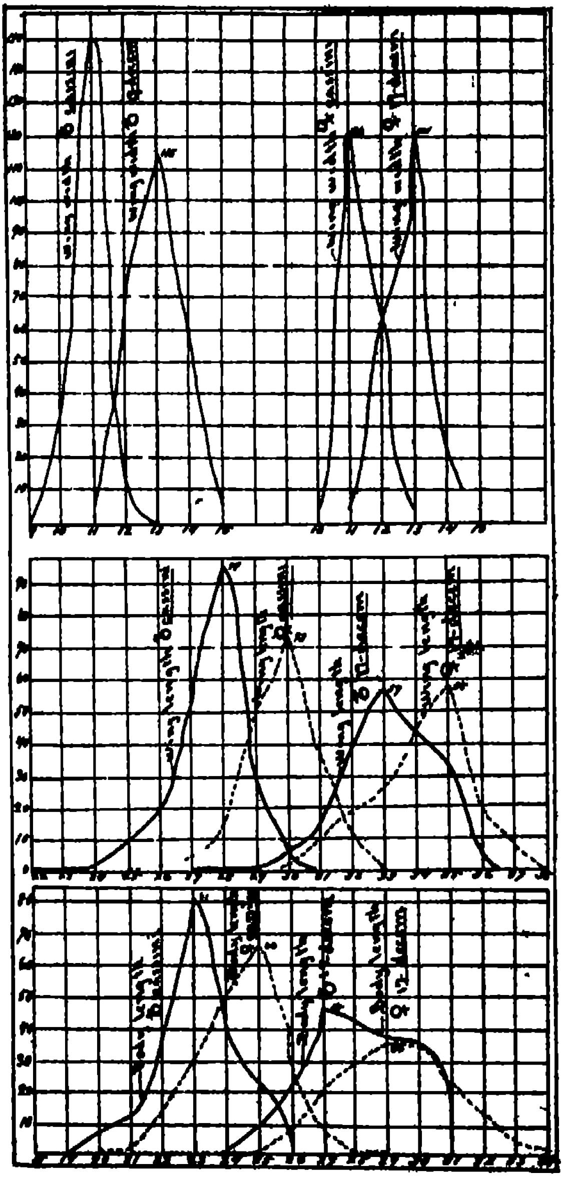
* Read before Section F, Am Assoc. Adv. Science, Pittsburg, July 1, 1902

† Inj. & Ben Ins., Rep. Mo. 1, p 20

‡ Bull. 14, Div. Ent., p 17.

OHIO NATURALIST. *Plate 2.*



OSBORN ON "VARIATIONS IN THE PERIODICAL CICADA."

normal forms, seems subject to wider variation than the other structures.

Measurements have been made of eight hundred specimens taken at random from various localities, the only point of selection being to get an equal number of both forms (in each sex) in order that the frequencies for each form should be fairly represented. All intermediate forms are represented in due proportion to their occurrence in the lots examined.

Results of the measurements show a very decided constancy for each variety and for each sex of each variety, the wing length of *cassini* males averaging 27 4 mm , width 10.9 mm. and body length 22.9 mm.; while for normal form the wing length is 33.1 m., width 12.5 mm. and body length 28 mm. For the females, *cassini* form, wing length 30 mm., width 11.3 mm., body length 24.1 mm., while normal 17-decem are wing length 34, width 12.8, body length 29.3 mm. The constancy of each can best be shown by curves of frequency for certain measurements, and this is shown in accompanying plate Taken by constancy of each form and it must be recognized that their forms are well established

I may add that measurements, so far as made, indicate same proportion in length of beak and ovipositor and in width of thorax It is believed that the wing length and width is as good a criterion of variation for the species as any other measurement that could be selected The length of the entire body varies somewhat with degree of contraction, and for females with condition of ovaries, but in the measurements given this was eliminated, as far as possible, by taking the specimens in same condition of maturity; most of them were dry, but some were killed in formalin.

Color variation is also very constant. In rare instances certain forms showed a narrow orange border to abdominal segments.

There is a difference in genitalia, but apparently not enough to exclude the idea of crossing, and Riley says the difference is not constant. I have not examined a sufficient number to pronounce upon the constancy, but from the method of coition I should think a pairing of opposite varieties, while not impossible, would be difficult. There is a very decided difference in note —, a fact recorded as early as 1830—and this, if the note is a mating call, would certainly have an influence in maintaining this isolation.

A special effort was made to note copulations and determine whether in any case the varieties crossed, or any efforts were made toward crossing, but out of seventy pairs taken in *coitu* not a single instance of *cassini* paired with normal 17-decem form has been seen. There is here, then, a very evident case of isolation due to sexual selection, and it would appear on this basis every opportunity for perpetuation of the variety.

There is, so far as I can learn, no positive evidence that the variety is a dimorph, which may reproduce the normal type, or that alternates with it. It is certainly not a sexual dimorph, as both sexes are represented in each form, and, as shown, elsewhere, pair by themselves; seasonal dimorphism is evidently not to be considered, so that I see no reason to use the term "dimorphic" as applied to this species.

The fact that the two forms appear simultaneously in the seventeen-year period and have so many characters in common is certainly good evidence of a very close relationship, and it would seem safe to say that they have sprung from a common stock, or very likely that one is a derivative from the other, which still represents the ancestral form While not yet determined, it would seem pretty evident that *cassini* is the derived form, since it appears less commonly than the other and has probably a more restricted range. If, possibly, a depauperate variety, it seems now to be fully established as a distinct form It pertains especially to the brood XXII having such wide range the present season (1902), and was noted especially by Riley for the same brood in 1868.

In my own experience it has been very rare in broods V and XIII, which I have had good opportunities to observe in Iowa in the occurrences of 1878, 1888 and 1895.

Summarizing · (1) There is a very constant color difference (2.) Measurements show very close adherence to two entirely different averages for length of body, length of wing and width of wing This is best shown by curves. (3) There is a totally different note characteristic of each form, which must be considered as representing different morphology of sound-producing organs as well as basis for selection of mates. (4.) No *cassini* forms have been found paired with normal forms and none have been recorded or reported by other observers. (5) There is a difference in genitalia, though perhaps not enough to exclude the possibly of mating, and Riley says the differences are not constant

Whether this form be called a variety, sub-species or species, is, it seems to me, of less importance than a recognition of its distinctness, and a determination, if possible, of its phylogenetic relationship. For purposes of designation it may conveniently be called *Tibicen cassini* Fisher

A variation of a quite different type was noted, but was represented by only two specimens.

I am under obligation to Max W. Morse for assistance in making the measurements.

OBSERVATIONS ON SELF-PRUNING AND THE FORMATION OF CLEAVAGE PLANES.

JOHN H SCHAFFNER.

Plants form separation layers and brittle zones for a variety of purposes, and the process is one of great importance in the life of many species, especially in those of a woody nature. The most familiar example is the annual phenomenon of the shedding of leaves and leaflets in our deciduous trees and shrubs By this means the plant gets rid of useless members or of such as would be injured by long periods of dry or cold weather.

When fruit or seed is developed there is again the necessity for some means by which these bodies may be separated from the parent. In many cases, both in perennials and annuals, the parts are pruned off by the formation of cleavage planes

The most interesting examples of the development of separation layers and brittle zones are those by which ordinary buds, twigs and branches are cut off or self-pruned This may be an adaptation for getting rid of leaves which do not themselves have the deciduous habit; for vegetative propagation; for the cutting off of herbaceous stems near the ground, as in certain perennial tumble-weeds and other geophilous plants, or it may be a process whose primary object is simply to rid the plant of surplus branches, thus preventing decay and allowing for the production of more new twigs and leaves the following season

Whether separation layers are ever produced in roots or underground stems is not known to the writer. But it seems that this would make an interesting though difficult subject for research

The process of self-pruning has been studied by the writer for several years, and during the past summer further observations were made to supplement previous work on this subject. A number of species were added to my former lists, including members of such widely separated families as Myricaceae, Aceraceae and Vacciniaceae A number of trees were found to prune abundantly in the spring. The soft maple (Acer saccharinum L.) was self-pruning abundantly from the first of May to the first of July. From some trees hundreds and even thousands of twigs from one to ten years old were shed during this period. The formation of the joint and cleavage plane is much the same as in the poplars, and most of the twigs had leaf buds with partly developed leaves. Acer rubrum L. also self-prunes in the spring and shed twigs from one to ten years old were collected on May 12th. No evidence of self-pruning was discovered in Acer saccharum Marsh. or Acer negundo L. Ulmus americana L. also sheds twigs in the spring, although autumn is the more usual time for this tree to self-prune. On May 16th a large tree was seen shedding twigs by the thousands. Sometimes a twig would drop every few seconds. On May 19th the ground beneath this tree was covered with twigs and parts of twigs from one to six years old on an average of about ninety per square yard. When it is stated that the area thus covered was over ten yards in diameter some idea can be obtained as to the number of twigs pruned off in a few weeks. This tree was still self-pruning on June 3d. Many other trees were pruning at this time. The weather was very dry and it is the writer's belief that dry weather accelerates the process of self-pruning.

W. E. Britton* reports that when the fruit of the elm is ripe gray squirrels prune off considerable numbers of branches, and suggests that injury might be done to trees in this way. It would appear, however, that an elm tree which naturally prunes off hundreds of branches a year could not be injured materially by losing a few twigs which squirrels might bite off while feeding.

The slippery elm (Ulmus fulva Mx.) does not self-prune branches, but it sheds large numbers of lateral buds every year, and has therefore no need of pruning off surplus branches. Foerste† has observed such a process in a number of trees

The cottonwood (Populus deltoides Marsh.) was found to self-prune occasionally from the time leaves appear in the spring until they are shed in the fall, although the main period of self-pruning is at the time of the shedding of the leaves. In a previous article, the black oak (Quercus velutina Lam.) was given in the list of oaks which are supposed not to self-prune. During the past summer, however, the writer found trees, on Cedar Point, Sandusky, Ohio, which were shedding a few small twigs by forming cleavage planes in basal joints. In late autumn the hackberry (Celtis occidentalis Mx.) sheds considerable numbers of leafy twigs of the season by means of the formation of a brittle zone in the same manner as was described in a previous article for the fruiting twigs.

The following plants, not mentioned in previous papers by the writer, self-prune by the formation of cleavage planes in basal joints.

Juniperus virginiana L.

Populus balsamifera L.

Populus tremuloides Mx.

Comptonia peregrina (L.) Coult. Mostly twigs of the season are pruned off.

Quercus velutina Lam.

Quercus imbricaria Mx. Self-prunes small twigs, but not abundantly.

Euonymus europaeus L. Twigs from one to eight years old are self-pruned.

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* W. E. Britton. The Gray Squirrel as a Twig-pruner. Science 15: 950. 1902.

† Aug. F. Foerste. The Identification of Trees in Winter. Bot. Gaz. 17: 180-189. 1892.

Euonymus atropurpureus Jacq. Shed twigs from one to four years old were collected.

Acer saccharinum L.

Acer rubrum L.

Polycodium stamineum (L.) Greene Self-prunes twigs abundantly.

Vaccinium vacillans Kalm.

The following two grapes were studied and found to prune in the normal way for such plants by the formation of cleavage planes corresponding to leaf nodes in twigs of the season:

Vitis labrusca L. Wild variety.

Vitis bicolor Le C.

As stated in the beginning of this paper cleavage planes are often formed to separate the fruit from the parent plant. It is interesting to note some of the ways in which this is accomplished. In the simplest cases a cleavage plane is formed at the basae of the fruit, which falls off while the peduncle dries and decays away. This is the case in Rhus glabra L. In others the separation layer is formed at or near the base of the peduncle, as for example in the ground cherry, Physalis pruinosa L. In this herb a very perfect cleavage plane is formed in the peduncle. In the apple and pear the separation of the fruit from the tree is accomplished in the same way by the development of a rather imperfect cleavage plane or separation layer. In some plants, as in Prunus americana Marsh, or in Benzoin benzoin (L.) Coult., the fruit first falls off and afterwards a cleavage plane is formed at the base of the peduncle. In the plum the peduncle sometimes dries off and is not immediately shed, even though the separation layer is formed. When the fruit is produced on panicles or cymes there are also several methods of procedure. In the dogwoods, as in Cornus asperifolia Mx., the berries drop off singly, and later the fruiting cyme is closely excised by a smooth cleavage plane; while in the smooth sumac, as stated before, the berries drop off in the same way, but the much branched panicle remains to decay gradually. In the chestnut (Castanea dentata (Marsh.) Borkh.), the stems which bear the burs become quite woody, but a cleavage plane is formed and the entire fruiting branch is thus pruned off.

The writer has had some difficulty in looking up the literature on the subject of self-pruning. This may be because no distinctive term has come into use for this common and most interesting phenomenon of our shrubs and trees. The following is a list of recent American papers bearing upon this subject:

1885 Trelease, Wm. When the Leaves Appear and Fall. Second Ann. Rept. Agr. Exp. Sta., Univ. of Wisconsin, for 1884. p. 59.

1892. Foerste, Aug. F. On the Casting-off of the Tips of Branches of Certain Trees. Bull. Torr. Bot. Club. *19:* 267–269.

1893. Foerste, Aug. F. On the Casting-off of the Tips of Branches of Certain Trees—Part II. Bull Torr. Bot. Club. *20* : 157–168.

1900 Bessey, C E Botanical Notes—The Annual Shedding of Cottonwood Twigs Science *12* 650.

1901 Schaffner, John H , and Tyler, Fred. J. Notes on the Self-Pruning of Trees Ohio Nat *1*: 29–32

1902 Schaffner, John H The Self-Pruning of Woody Plants. Ohio Nat *2* 171–174.

NOTE ON THE OCCURRENCE OF THE CIGARETTE BEETLE IN COLUMBUS.*

By Herbert Osborn.

The injuries of this insect have been reported from different points in the United States during the last eight or ten years but so far as I am aware no definite record of its appearance in this city has been published It may be of interest, therefore, to note its occurrence and the conditions under which it has proven troublesome It was first brought to my attention by one of the furniture firms of the city who reported the damage of certain plush upholstered furniture and desired information as to the insect and especially in reference to the probability of its having gained entrance into the articles while in their possession. An examination of the furniture showed the plush covering penetrated at points and the insect occurring in considerable numbers in the cotton immediately beneath the plush and in many cases, fragments of the plush covering mingled with the cotton. Underneath the cotton in the filling, no specimens were observed This evidence seems to show quite conclusively that the insect had entered after the covering had been put in place and was not due to the presence of beetles or their eggs or larvæ in the material used for filling. It seems that the furniture had been sent to this firm for recovering; kept in their shops but a few days, and returned to the owner, and that the injury of the insect had not been discovered until some eighteen months after being in the shops; and that in the meantime the house had been closed and unused for a period of some six weeks. The conclusion seems evident that the attack originated in an infestation occurring, very likely, during the time that the house remained unused, the beetles gaining access by means of cigarette packages or some infested article of furniture, and the fact that the articles were unused permitted the insect to become fairly well established. It may be remarked that this insect is likely to become prevalent in many of the cities of the State, and that prompt attention to its destruction, wherever it is noticed, is very important. Where occurring in upholstery the most convenient treatment is to apply benzine and gasoline, but of course due precaution against the possibility of any flame coming in contact with the fumes must be taken. The firm in question are to be commended for their attitude in the matter, as they were anxious to make good any injury that could be traced to their own factories or to negligence on their part. The fact that no furniture in their establisnment has shown injury from this insect, along with the fact that the furniture was in their possession for so short a time, makes the conclusion very certain that the infection was not due to their rooms or factory being infested The insect as recognized in the larval stage is a small, coiled grub, nearly white in color, the head marked with brown patches, especially on the lower portions. The adult is a minute hairy beetle, about one-eighth inch in length.

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*Read before the Ohio State Academy of Science, Nov. 28, 1902.

Specimens in the department collection have been received from Prof. J C. Hambleton, who found them at West Jefferson. Mr. Dury reports them in Cincinnati, and a recent Bulletin from the division of Entomology, Department of Agriculture, reports them as destructive in cigarette packages and other tobacco products in Cincinnati

The fact that this insect occurs in a great variety of materials renders it of great importance. Its first destructive appearance being noted in packages of cigarettes gave it its name, but it has been observed in a great many different articles, such as starchy foods, cotton goods, silk, plush, upholstery, etc

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THE FLORA OF LITTLE CHICKEN ISLAND.

JOHN H SCHAFFNER.

On the 22nd of last June, I paid a visit to the Hen and Chicken Islands which lie in Canadian waters beyond North Bass Island. After landing on the Hen Island there was time enough to visit only one of the three "Chickens" which accompany the "Hen." This was the one farthest south-east, known as Little Chicken Island, the other two being called Big Chicken and Chick Island.

Little Chicken Island is a nestling place for the common tern, and the higher part of the surface was covered with tern nests, a few of which contained young birds. The island is a rocky reef covered with coarse drift pebbles. The central part is simply a ridge of large, loose pebbles, without vegetation of any kind, and around this is a zone of herbs reaching to the water's edge, with a good-sized bunch of willows on one side, none of which are much over six inches in diameter.

I made a careful search for all the species of plants growing on the island, and since such a flora must be quite transient, it is here recorded. Aside from a few of the lower algae and fungi on the rocks and dead organic matter, Marchantia polymorpha and several mosses were the only lower forms present. Fifteen species of seed plants were determined, and there may have been several more species of Polygonum, but they were not mature enough for satisfactory determination. Following is the list of species ·

Echinochloa crus-galli (L.) Beauv.
Agrostis alba L.
Avena sativa L.
Salix amygdaloides Andr.
Ulmus americana L.
Polygonum lapathifolium L.
Polygonum persicaria L.
Atriplex hastata L.
Scutellaria lateriflora L.
Lycopus americanus Muhl.
Cephalanthus occidentalis L.
Leptilon canadense (L.) Britt.
Bidens frondosa L.
Bidens connata Muhl.
Carduus sp.

Of these the Avena, Ulmus, Lycopus, Cephalanthus and Carduus were leading a very precarious life. It will be seen from the list that there are only two plants which have barbed fruits. Four have adaptations for wind distribution and may have been carried in this way. The other nine have small seeds which may have floated over from neighboring islands or they may have been carried in the mud sticking to the feet and feathers of birds. An apple was found washed ashore, but there would be little chance for such a plant to gain a foothold on the island. It is probable that most of the seeds which arrive find it impossible to establish themselves, because of the limited amount of soil and other adverse conditions.

COMPASS PLANTS OF OHIO.

HARRIET G. BURR.

The name "compass plant" was first given to *Silphium laciniatum*, commonly called Compass plant or Rosin-weed, one of the family Compositæ and found on the prairies of North America. It is the best known of this class of plants and affords perhaps the best illustration of them. The name originated with the hunters on the prairies who observed that the leaves had a peculiar vertical position with the edges pointing north and south. Even under cloudy skies they were able to make use of this peculiarity as a guide to directions.

The vertical position of the leaves is due to the twisting of the leaf-blades; this seems to be confined to those plants which prefer open, sunny places and which grow in the warmest parts of the year, and to this we may look for an explanation of the phenomenon. The full effect of the sun's rays upon the leaf during the hottest part of the day, especially on the prairies where the temperature sometimes rises very high, would cause an over-heating and an excessive amount of transpiration which would be exceedingly injurious to the plant and might cause its death. To avoid this the leaves twist so that they have what is called the "profile position," the sun's rays falling directly upon the edges at mid-day and upon the surfaces only at morning and evening. It is interesting to note that when compass plants are found growing in damp, shady places, the leaves have the ordinary position, i. e., not vertical or twisted. This placing of the leaves horizontally in the shade and vertically in dry, sunny places may be seen in many plants, including shrubs and trees, though in only a few of them do the leaves have a north and south position. The name "compass plant," however, is not restricted these last.

The following is a list of our Ohio compass plants:

Lactuca Scariola L. Prickly Lettuce.
Lactuca virosa L. Strong-scented Lettuce.
Silphium laciniatum L. Compass-plant, Rosin-weed.
Erigeron Philadelphicus L. Philadelphia Fleabane.
Lacinaria scariosa (L.) Hill. Button Snakeroot.
Grindelia squarrosa (Ph.) Duval. Broad-Leaved Gum-plant

Of these, *Lactuca virosa* (formerly confused with *L. Scariola*) and *Erigeron Philadelphiacus* are very common. In the latter the twisting of the leaves is especially noticeable in the spring, although they do not have a north and south position. *Silphium laciniatum* is found on the prairies in the northwestern part of the State.

A RECORD OF OBSERVATIONS ON THE DANDELION.

J D SIMKINS

The following observations were made by my son, Don C. Simkins, upon two dandelion heads. One was studied from May 10 to June 4, 1901; the other from May 12 to June 4, 1902. Observations were recorded three times a day—morning, noon and night In the notes below "No. One" refers to the first head and its scape; "No. Two" to the second head and its scape No. Two was the more typical specimen.

The dandelion grows in a funnel-shaped opening which it makes at the surface of the ground. No. One remained in this funnel for two days after being discovered, without lengthening its scape; No. Two did the same It was five days after No One was discovered before it bloomed; after No Two, eight

Beginning at seven o'clock in the morning, it took one hour for the head of No. One to open the first morning it bloomed, and in about five hours it began to close It took one hour to fully close. Only the outer half of the flowers bloomed the first day In opening and closing, this head made the same record the second day, except that the inner half of the flowers were also in bloom On the third day the head opened a short time. No Two made the same record On some days the dandelion remains in bloom until later in the afternoon

After flowering No One required fifteen days to ripen its seed; No Two, nine The cold rainy weather delayed No. One When the fruit on No One was ripe it took forty minutes for the head of pappus to open. The plant made a mistake, for it rained and washed a part of the seed off, while a part hung on for three days; but possibly it could not wait any longer, for it had been delayed by four days of rainy weather, except the day before the head opened. No Two opened in the same time, the wind rose and the parachutes were carried away—all on the same day. In fine weather you will see many pappus heads in the forenoon and but very few in the evening All the seeds in Nos. One and Two seemed to mature. This plant is so very numerous that many insects are induced to aid in pollination.

During some days, as well as some nights, the scape does not grow. In No. One it grew during ten nights; in No. Two, during thirteen. In No. One it grew during seven day-times; in No. Two, during nine. At certain times the scape makes a rapid growth. No. One, on each of two non-successive nights, grew one and one-half inches, and during another night two inches. No. Two lengthened one inch on each of two non-successive nights, two inches on one night, and four and one-third inches during another. No. One never grew one inch during any daytime except once; No. Two lengthened one inch in one daytime and two inches in one other. No One lengthened rapidly during the last three days and nights just before it completed its growth. No. Two did the same, except that it grew an eighth of an inch after the seed had been scattered, probably owing to a shower No. One did not grow any for three days and nights just before opening the head of pappus, but the weather was cold and rainy; No Two lengthened very rapidly during the three days and nights just before scattering the seed, probably because the weather was warm and windy, with a slight shower the night before the head opened No. One did not grow any during the three days and nights just after blooming, probably because its strength had been exhausted in flowering, No. Two did the same. This was the longest period of rest from growth that either plant took The scape of No. One grew over an inch during the days and nights the head was in bloom, No Two, two inches No. One grew one inch during the day and night just before blooming, No Two, four and one-third inches the night previous to blooming—its most rapid growth

In No. One, previous to blooming, the scape bent over to lower and protect the head, but became erect the night before the head opened. By this process the head was elevated over an inch. No Two did the same. Along the roadside this process often makes a difference in elevation of the head of four inches, especially if the neighboring vegetation is growing After blooming the scape of No. One again flexed to lower and protect the head while the seed should ripen. By the scape's assuming a compound curve the head stood erect The scape became straight and vertical two days before the seeds were to be scattered, thus raising the head an inch more than it otherwise would be. Along the roadside this change in the direction of the scape often elevates the head as much as six inches. The record for No Two was the same as for No One

In No One the corollas died and dried in about five days after blooming, and at the end of three more the growing pappus stalks pushed them off; for No. Two no record was made In No. One the plant was five days in reflexing the scales of the outer involucre; but after they were once down they never again became erect The same was true of No. Two. In No. One the scales of the inner involucre curved outward near their middle to permit the flowers to bloom, but became erect in the evening and at night to close the flower. They also remained erect while the seed was ripening. When the head of pappus was ready to come out this was accomplished by the receptacle's changing from a concave disk to a convex one. This mechanical device not only opened up the head of pappus, but reflexed the involucres at their base. They never again left this position. No. Two made the same record. The pappus disk is also concave until it becomes convexed to help open the pappus head. While it is concave the pappus hairs stand erect and parallel; but by becoming convex the disk forces the hairs to radiate like the stays of an open umbrella

In No. One, the head faced the sun from morning until noon while in bloom; No. Two did the same. But this seems to be a rule to which there are exceptions.

After the seed is scattered the scapes soon wilted and fell to the ground.

In No. One the full length of the scape was twelve inches; in No. Two, nineteen inches The grass was taller around No. Two. In tall grass or in a pile of rails, the scape may reach a yard in length and stand erect most of the time, while on lawns that are frequently mowed they are usually short.

No. One grew in the back yard, on the northwest side of its bunch, and when the scape flexed it always bent in that direction. No. Two grew near the same place, on the south side of its bunch, and when the scape bent it was always in that direction. Of the 76 records made of No. One, 28 were marked "rainy" and 18 "cold", in the 68 made for No Two, 11 were marked "rainy" and 8 "cold."

PREHISTORIC ANTHROPOLOGY.

[ABSTRACT]

Address of the Retiring President, Mr. Mills, Delivered at the November Meeting of the Biological Club, at Orton Hall.

Mr Mills gave a review of prehistoric Anthropology, which is accredited to the scientists of Denmark, who had stamped the meaning upon the word Anthropology, designating it as a science well recognized and as definite as the science of Botany, Chemistry, Zoology or Geology. He also reviewed the obstacles encountered by the investigators in the study of prehistoric Anthropology. A great many of the discoveries were due to the persistence of Professor Steenstrup, one of the Commissioners of Denmark, who first discovered that prehistoric man had the domesticated dog by finding bones that had the appearance of being gnawed. By applying these observations to the village sites of Ohio, Mr. Mills was able to discover at the Baum village site along Paint creek, and the Gartner Mound along the Scioto, a number of bones that had the appearance of being gnawed, and this led to the discovery of the domesticated dog at this place. These bones were afterward sent to the National Museum, and there identified and described by Professor F. A. Lucas as a species much the size and proportion of the bull terrier, and resembling very much the dogs found in the old village sites in Texas and the old Pueblos.

Mr. Mills also stated that at the present time in all Europe every dolman and village site is known to the scientist; the borders of all the inland lakes have been studied with care, for it was thought that many of them were sites of sunken forests, and many of these sunken trees could easily be detected in time of low water. But as investigations went forward it was soon shown, after lifting one of those trees from its bed, that it was a sharpened pile, bearing evidence of human workmanship; that these had been driven into the ground and the tops of these piles in the remote past served as the sites of the homes of these early people. At the same time a study of the various implements found in the shell heaps of Denmark and in the inland lakes of Switzerland and dolmans of various parts of Europe, brought out the fact of the similarity of the implements of these different countries. Therefore, by reason of this similarity, the scientists of that time were able to determine the prehistoric ages by comparing the different implements of these various countries and the recognition of the resemblance between them, and by so doing they were able to correlate and identify the culture of early man. It was also found in later years, as the knowledge of prehistoric world increased, that this great similarity of European implements was found to extend to the Western Hemisphere; that practically all of the implements and ornaments made of stone, bone and shell found in Europe could be readily duplicated in the United States. Ever since the establishment of the science of Anthropology the question that has been uppermost in the mind of the anthropologist is to find out the orgin of the people that inhabited this country In relation to their unity or diversity the scientists of this country have been accepting the evidence furnished by craneology, by language and by social institutions of the American tribes and their predecessors.

Dr Morton, in 1839, brought out the idea of the homogeneous physical characteristics of the aborigineesof America, extending from Terra del Fuego to the Arctic circle, and it has been accepted without question, and has more recently been made the basis of a widely comprehensive deduction Other scientists believe that the American Indian is essentially separate and peculiar, a race distinct from all others.

A review of all the theories advanced on both sides was extensively discussed, but the speaker could not bring out all the points that may be produced to show the unity or the diversity of the human race, but was sure that the student of anthropology, with the wealth of material and opportunities now afforded, will be able in time to solve the problem which for the last three-fourths of a century has been troubling us, namely, the problem of the unity or the diversity of prehistoric man in America.

Mr. Mills also reviewed the work of the Ohio State Archaeological and Historical Society at the Baum village site along Paint creek and at the Gartner Mound along the Scioto. At the Baum village the work this year fully demonstrated that the people lived in small clans or family groups; that these clans had their own burial grounds, refuse pits, etc. Explorations carried on in previous years developed no burials having earthen jars placed with them. However, during the past year's work burials were found with earthen jars placed at the head. These jars invariably contained a spoon made of ocean shell or the back of the common land turtle, cut in form to be used for the same purpose. In other jars large awls were found, which were no doubt used for conveying food to the mouth.

The light that is thrown upon one brief period of the past by the study of these village sites, surrounded as they are by the mounds and earthworks of that by-gone people, testifies that they were agriculturists as well as hunters; that they lived in the family group or clan; that each clan was versed in the manufacture of pottery, ornaments and implements, that they had the domesticated dog, and that this dog resembles very much the dogs found in the Southwest and even in Mexico Moreover, these people had communication with the world other than their own habitation, as is evidenced by the intercourse with which they obtained mica, copper, obsidion and ocean shell.

The latter part of the summer was devoted to mound work, and the Gartner mound, situated about six miles north of Chillicothe, was thoroughly examined. Here very many new and interesting things were discovered. Large pieces of perfect pottery were found with burials, and in some cases the material ready to be made into pottery was placed with the burial. A large platform was uncovered, extending thirty-four feet east and west and twenty-three feet north and south. The platform was made of tamped clay and covered over the top with ashes ranging in thickness from six inches to two and one-half feet; these ashes were filled with animal bones, implements and ornaments of these people. In all forty-four skeletons were removed from this mound. Seventy-five per cent. of these skeletons had implements and ornaments placed with them. Great quantities of the canine teeth of the mountain lion and wolf were found, also large shell gorgets set with pearls. Taking it all in all this is one of the most interesting mounds examined in this section.

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*SOME CLIMATIC CONDITIONS OF OHIO.

OTTO E. JENNINGS.

Plant Ecology has to do with the adaptations and modifications of plants to each other and to the outside world. In taking up the study of plant ecology it is necessary, therefore, that factors external to the plant be taken into consideration. We must study the environment of the plant as well as the plant itself.

Probably a majority of the factors which make up the environment of plants and thus have to do with plant ecology fall within the domain of meteorology. Light, temperature, wind, and moisture (in its different forms) are all very important ecological factors and to their variations both singly and in combination are due most of the characteristic differences in the flora of different regions.

Practical workers along the different lines of plant production must keep within more or less definite limits determined by meteorological conditions. No farmer, orchardist, or gardener can well afford to ignore such things and much less can the ecologist, working more or less upon a theoretical basis, expect to accomplish much without taking into account these various meteorological factors.

In connection with Prof. Schaffner's work on the plant ecology of Ohio the writer has endeavored to work out the general meteorology of the state as far as it may have some part in the ecology of the region and it is the object of this paper to present the results of such investigations.

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* Read before the Ohio Academy of Science, Nov. 1902, Columbus, Ohio.

In view of the two very important requisites to trustworthy averages ;—(*a*) records running through a long period of years and (*b*) as uniform distribution over the State as possible, the following stations were selected as representing the meteorological conditions of Ohio Ashtabula, Cleveland, Findlay, Montpelier, Sandusky, Toledo, Wooster, New Alexandria, Columbus, Milligan, Marietta, Portsmouth, Clarksville, Cincinnati, and Greenville.

These stations have records ranging in point of duration from six years at Ashtabula, eight years at Milligan, and ten years at Montpelier, on up to twenty-four years at Columbus and thirty-two years at Toledo, Cleveland, and Cincinnati. Although it is claimed generally by meteorologists that a longer record is necessary for accurate averages than is yet possessed by some of the stations named, it is believed, in view of the uniformity with which the stations having the shorter records have checked up with those having longer records, and in view of the fact that in cases of doubt records of neighboring stations were in several cases consulted, that very fair general averages have been obtained and that longer records will not materially alter our charts

PRECIPITATION, TOTAL (Plate III Map II.)

Taking up first the subject of precipitation we find no very great range in the normal annual amount. The valleys of the Ohio and Miami Rivers have the greatest precipitation, about forty inches per year, while the valley of the Maumee River has the least,—below thirty-five inches.

SNOWFALL (Plate III MAP I)

Precipitation in the form of snow shows an entirely different set of averages from that of the total precipitation. The northern part of the state shows some very striking extremes. In less than one hundred miles along the shore of Lake Erie,—from Sandusky to Ashtabula,—the annual snowfall rises from thirty to sixty inches. South from Ashtabula the snowfall decreases to twenty inches in 150 miles, while a line drawn through the central part of the state from north to south would cover in 200 miles a range of but ten inches of snowfall.

MAXIMUM MONTHLY PRECIPITATION.

Another phase of the subject of precipitation which is of some importance ecologically is that of the maximum and minimum monthly precipitation. The records here again indicate very interesting differences in the state Throughout the southwestern part of Ohio March is the wettest month of the year The range was from 5.69 in. at Cincinnati to 9 02 in at Portsmouth for the region having the maximum precipitation in March With the exception of Milligan, with a maximum of 6.64 inches in June, the remainder of the state has its rainiest season in July with maxima ranging from 4.63 inches at Cleveland to 6 95 inches at Ashtabula

MINIMUM MONTHLY PRECIPITATION.

For the minimum monthly precipitation fourteen of the fifteen stations report October, the range being from 0 85 inches at Clarksville to 1.29 inches at Ashtabula The one station not agreeing with the above was Sandusky with a minimum of 0.95 inches in December

RAINY DAYS. (Plate III Map III.)

The region bordering Lake Erie, as might be suspected, leads the state in the total number of rainy (or snowy) days per year Cleveland has precipitation 150 days in the year, while in the extreme northwestern and in the southeastern part of the state the number falls to below 100

CLEAR DAYS PER YEAR. (Plate III Map IV.)

Sandusky reports the least number of clear days (69) while Ashtabula reports the greatest number,—over 160. Just why this should be is rather difficult to say. It was thought that perhaps some of the difference might be due to the shortness of record at Ashtabula (6 years) or to a lack of uniformity in sky observations at different stations, but the examination of the records of neighboring stations seemed to confirm the reliability of Ashtabula's records as averages of that locality.

CLOUDY DAYS

The number of cloudy days follows about the same order as the rainy days. A strip running south and west from Sandusky to Cincinnati through the central part of the state, includes the region having the greatest number of cloudy days. Sandusky leads with 169 per year

The following table gives the above data in tabular form, complete for each station

	PRECIPITATION (Inches)						SKY (No days)		
	Total	Max Monthly	Month	Min Monthly	Month	Snow	Rainy	Cloudy	Clear
Ashtabula	38 8	6 95	July	1 29	October	64 2	114	1 0	166
Cincinnati	38 5	5 69	March	90	October	18 6	139	122	118
Clarksville	40 0	6 60	March	85	October	18 5	133	118	149
Cleveland	36 3	4 63	July	66	October	48 8	159	139	102
Columbus	38 1	6 22	July	81	October	20 3	149	131	104
Findlay	36 8	6 36	July	1 15	October	33 8	106	113	115
Greenville	38 4	6 27	March	88	October	23 0	111	98	91
Marietta	42 6	6 14	July	1 12	October	1, 6	121	132	97
Milligan	46 9	6 64	June	87	October	26 3	99	76	21
Montpelier	37 3	6 14	July	94	October	36 6	81	97	106
New Alexandria	43 1	6 19	July	1 11	October	26 6	96	135	132
Portsmouth	41 2	9 02	March	1 03	October	9 9	122	107	129
Sandusky	33 6	5 61	July	95	December	26 9	140	169	69
Toledo	30 9	4 80	July	1 01	October	32 8	38	135	108
Wooster	37 7	6 08	July	96	October	31 5	129	122	121

MEAN TEMPERATURE (Plate IV Map V)

Taking up now the temperature of the state we find a normal range of 6° F —from 49° F in the extreme north to above 55° F in the south The annual isotherms vary quite regularly with the latitude excepting in the north central part of the state as the map will show

EXTREME MAXIMUM TEMPERATURE (Plate IV Map VI)

The highest temperature is normally reached in the latter part of July The only station differing from this was Milligan with a maximum of 100° F on August 11 The other fourteen stations ranged in extreme maxima from 100° at Portsmouth down to 92° at Greenville and 93° at Ashtabula

EXTREME MINIMUM TEMPERATURE (Plate IV Map VII)

The extreme minimum temperatures vary by twice as many degrees as do the extreme maximum At Portsmouth the average of lowest records is one degree below zero while Montpelier averages thirteen below and Milligan eighteen below zero The time of the coldest averages is about January 24 at Columbus, this being the earliest and February 7 at Ashtabula As has been previously shown by Prof Moseley in his Sandusky Flora, ' ice drifting eastward in Lake Erie may prolong the cold season at points toward the eastern end of the Lake This probably explains the lateness of the records of extremes at Ashtabula. The average for Milligan just given I think is probably too low. The records have been kept for only eight years and during this time has occurred the exceptionally low temperature of 1899 which must necessarily have unduly influenced the average. Yet it must be acknowledged that the region about Perry County and northwestward shows very low maxima; throwing out altogether its two lowest records. Milligan would still hold the lowest minima among the fifteen stations,—or, even leaving Milligan out altogether, the map will still remain practically unchanged.

AVERAGE EXTREME RANGE OF TEMPERATURE.

(Plate IV Map VIII)

By average extreme range of temperature is here meant the difference between the average of extreme minimum temperatures and the average of extreme maximum temperatures

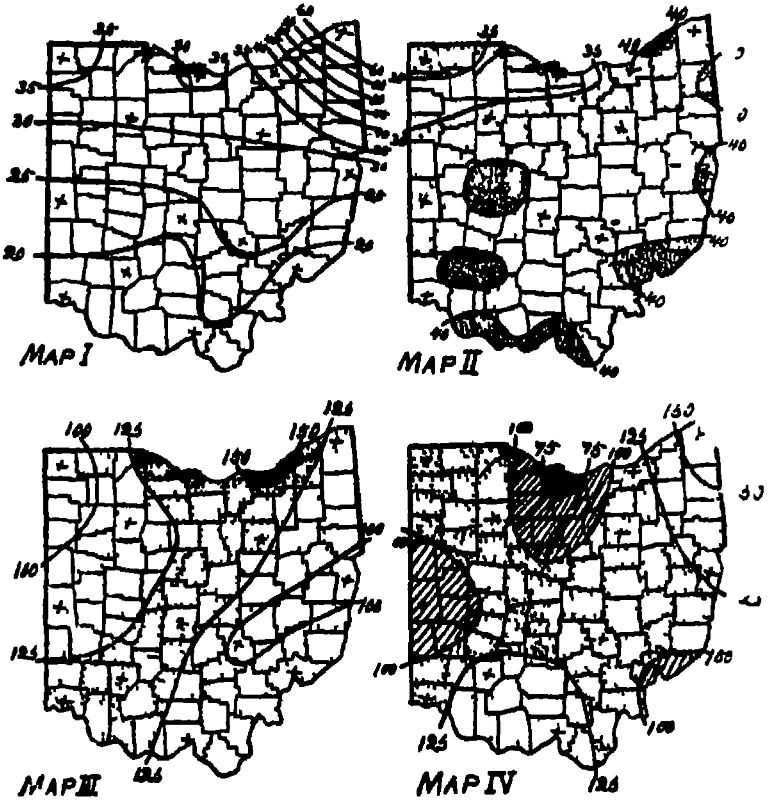
Considered thus the smallest range (The most equable temperature) is to be found along the shore of Lake Erie and in the immediate vicinity of the Ohio River, while the region of greatest extremes occurs in a strip commencing at the northwest corner of the state and continuing southeastward reaching its culminating point in Perry County, not more than fifty miles from the Ohio River, where the range is as small as anywhere in the state,—(Milligan 115° range and Marietta 100°)

The greatest ranges among the fifteen stations for any individual year were, as far as the records showed, at Milligan in 1899, 140° F (39° to 101°) and at Findlay the same winter, 121° F. (22° to 99°)

TEMPERATURE TABLES

	Length of Record Years	Av'ge Maximum (Extremes.)		Av'ge Minimum (Extremes.)		Average Range Between Extremes	Greatest Range Recorded in any One Year	
		Degrees Fahr	Date.	Degrees Fahr	Date		Degrees Fahr	Year
Ashtabula	5	93	July 20	— 7	Feb 7	100° Fahr	104° Fahr	1899
Cincinnati	31	97	July 22	— 3	Jan 27	100 "	116 "	1899
Clarksville	11	97	July 29	— 6	Jan 27	103	121 "	1899
Cleveland	31	94	July 24	— 6	Jan 31	100	112 "	1897
Columbus	25	97	July 25	— 6	Jan 24	113 "	118 "	1899
Findlay	10	99	July 26	—10	Jan 28	109 "	121 "	1897
Greenville	13	98	July 31.	— 9	Jan 31	101 "	111 "	1899 1901
Marietta	18	95	July 21	— 4	Jan 27	99 "	116 "	1899
Milligan	7	100	Aug. 11	—18	Jan. 27	118 "	140 "	1899
Montpelier	9	96	July 23	—13	Jan. 28	109 "	118 "	1892 1897
New Alexandria	15	95	July 24	— 6	Feb. 1	101 "	116 "	1899
Portsmouth	18	100	July 9	— 1	Feb 4	101 "	119 "	1899
Sandusky	24	96	July 18	— 5	Feb 2	101 "	108 "	1897
Toledo	31	98	July 21	— 6	Jan 27	104 "	114 "	1897
Wooster	16	95	July 27	— 9	Jan 28	104 "	118 "	1898

OHIO NATURALIST *Plate 3*



JENNINGS on Some Climatic Conditions of Ohio

EXPLANATION OF MAPS

MAP I Mean Annual Snowfall in inches of snow

MAP II Mean Annual Precipitation in inches

The blank space denotes areas of less than 35 inches of precipitation the medium dotted 35 to 40 inches and the heavy dotted over 40 inches

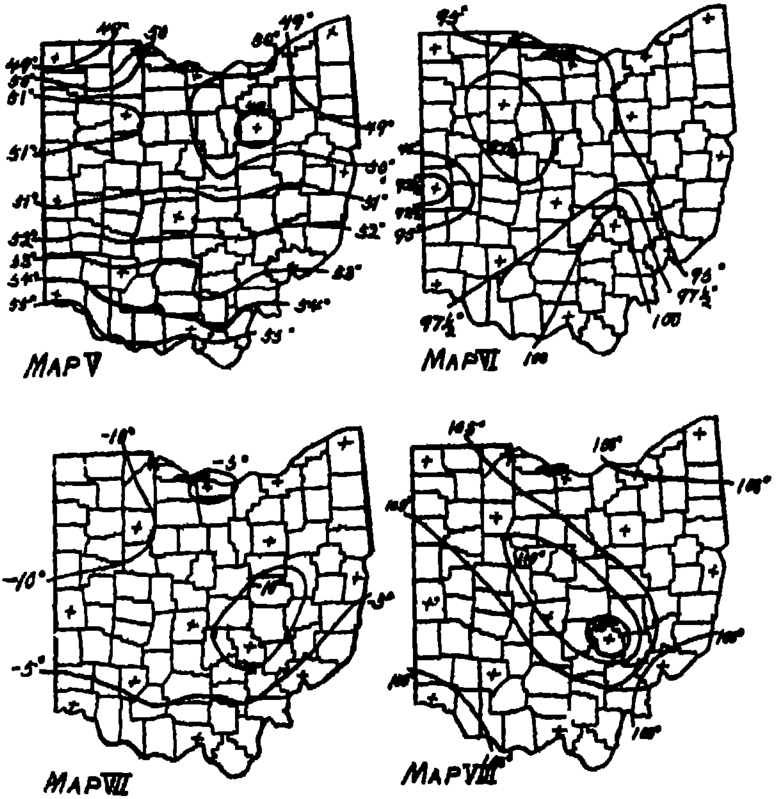
MAP III Average Number of Days per year in which Precipitation Occurs

The blank space represents areas of less than 100 days and the successively darker areas respectively 100 to 125 125 to 150 and the darkest 150 or more days

MAP IV Average Number of Clear Days per year

The clear days increase from darkest area less than 75 through the successively lighter portions up to 150 or more in the blank space

OHIO NATURALIST Plate 4



JENNINGS on Some Climatic Conditions of Ohio

EXPLANATION OF MAPS

MAP V Mean Annual Temperature

Lines denote mean temperature for the year ranging from 49 to 55 degrees Fahrenheit

MAP VI Mean Maximum Temperature

Lines pass through points having the same average of maximum temperatures Lines differ from each other by 2½ degrees Fahrenheit

MAP VII Mean Minimum Temperature

Lines pass through points having the same average of extreme minimum temperature The lines differ from each other by five degrees Fahrenheit

MAP VIII Mean Annual Range of Temperature

Lines pass through points having the same average range between the extreme minimum and extreme maximum temperature of the year

FASCIATION

LUMINA C RIDDLE

The phenomena of fasciation are sufficiently striking to attract the attention of the most casual observer and the malformation occurs so frequently that nearly every person has seen one or more cases of it It manifests itself usually by a remarkable broadening and flattening of the stem crowded phyllotaxy and often spiral twisting and splitting of this broadened axis although the portion of the plant affected and the exact character of the growth varies with the nature of the plant Those having the rosette habit throughout their entire life as the common dandelion show fasciation in the peduncle of the inflorescence In the thistle (*Fig 2*) which has the rosette habit during the first year

Fig 1 *a* *Ailanthus glandulosus* *b* *Ranunculus abortivus*

and is stemmed during the second year it has only been observed in the second year's growth and affected the entire stalk In the herbaceous hollow stemmed plant of *Ranunculus abortivus*, (*Fig 1* b), the entire stem was found fasciated and inside was found a reversed cylinder having the delicate epidermal layer within and a well developed ring of fibro vascular tissue surrounding it In *Erigeron philadelphicus* the leaves were so closely compacted that the stem was entirely concealed while the top of the stalk was twisted down. In woody plants fasciated stems are nearly always split or twisted, often both, as shown in *Ailanthus glandulosus* (*Fig. 1, a.*)

Fig. 2

Fasciated Thistle, *Carduus lanceolatus*

Fasciation is found frequently occurring in many cultivated plants; the flowers, hyacinths, gladioli, narcissus, violets, geraniums, nasturtiums (*Tropoeolum*); the garden vegetables, cabbage or *Brassica oleracea*, and beets, *Beta vulgaris*, and trees, Pinus, Thuya, Taxus, Salix, Alnus, Ulmus, Prunus and Populus. Several plants are cultivated only in their fasciated form, the most familiar one being the coxcomb, *Celosia cristata*, L., and to this peculiar distortion is due the wide crest so greatly desired by the florist.

That it is possible to transmit the tendency to fasciate we have as proof not only the coxcomb but the results of experiments carried out by De-Vries, with eight different plants in all of which fasciation proved to be hereditary. The percentage of fasciated seedlings in the fourth generation was 40; while in the fifth, 24 per cent. showed marked fasciation. Wherever there was a tendency to revert to the normal it seemed to result from scanty nutrition, while where abundance was supplied the number of fasciated plants was in great predominance.

Goebel in his "Organography of Plants," states that it is difficult to answer the question as to the cause of fasciation. He classes it under malformations which appear spontaneously and are not caused by external conditions although these may call the deformity forth. Other authors suggest various causes which are many times wholly contradictory. Union of several stems, flattening of one growing point, over nutrition, lack of nutrition, decline of vital energy, injury combined with superabundance of food, and shortening of the leafy axis have all been suggested and in many cases are supported by apparently convincing proof. Fasciation to a slight degree was produced experimentally by the writer. Sturdy seedlings of the lima bean were selected and the plumule removed before the cotyledons were wholly expanded. Adventitious buds appeared in the axils of the cotyledons, much crowded together and compressed between stem and cotyledons and several of these gave rise to fasciated growths. In this case the amount of stored nutrition was that required for the normal seedling. Development was arrested by the removal of the plumule so that the independence of the plant was delayed. Buds were crowded and there were several closely placed together. But what the internal disturbances are that give rise to this peculiar development even the best of authorities hesitate to state positively.

Fasciation has been known to occur in the following plants that are reported in the Ohio Check List. The nomenclature is that used in Britton's New Flora.

Zea mays
Asparagus officinale
Salix alba
" vitellina
Phytolacca decandra
Ranunculus abortivus
acris
bulbosus
repens
septentrionalis
Berberis vulgaris
Lepidium campestre
Bursa bursa pastoris
Hesperis matronalis
Spiraea salicifolia
Fragaria vesca
Trifolium pratense
repens
Amorpha fruticosa
Robinia pseudacacia
Linum usitatissimum
Ailanthus glandulosus
Euphorbia cyparissias
Decodon verticillatus
Althaea rosea
Chamaenerion angustifolium
Onagra biennis,

Gaura biennis
Convolvulus sepium
arvensis
Myosotis palustris
arvensis
Echium vulgare
Mentha aquatica
Linaria canadensis
Antirrhinum majus
Digitalis purpurea
Plantago rugelii
Dipsacus sylvestris
Campanula rapunculoides
Cichorium intybus
Leontodon autumnale
Tragopogon porrifolius
Taraxacum taraxacum
Lactuca sativa
Bellis perennis
Erigeron philadelphicus
Rudbeckia hirta
Anthemis arvensis
nobilis
Chrysanthemum leucanthemum
Carduus lanceolatus
arvensis.

THE DEVELOPMENT OF THE EMBRYO-SAC AND EMBRYO OF CLAYTONIA VIRGINICA.*

MELVILLE THURSTON COOK

Claytonia virginica Linn. was selected as a type for class study. The number of interesting points led me to complete the series of preparations and prepare the results for publication The wide distribution and the ease with which the material can be killed and prepared for class work may make it an equally desirable type for others who may wish to study a dicotyl with unequally developed cotyledons

METHODS

The material was killed and fixed in Flemming's solution, passed through the alcohols, imbedded in paraffin and cut on a Minot microtome. In most cases the sections were cut rather thick For the very young stages only the calyx was removed. The fluid will penetrate the ovules readily until they are old enough to change their color from white to brown or black ; after that it is necessary to puncture the integuments. A combination of anilin safranin and gentian violet gave the best results.

MEGASPORES AND EMBRYO-SAC

The single archesporial cell is hypodermal in origin, and can be easily recognized from the surrounding cells of the nucellus. From this a single tapetal cell is formed, which may divide again either by anticlinal or periclinal walls (Figs. 1, 2*b*) In a very few cases three tapetal cells were observed (Fig 2*b*). Four megaspores are formed in the usual manner (Figs. 2*a*, 2*b*) The lower or functional megaspore enlarges at the expense of the three potential megaspores and the tapetal cells (Fig 3) The functional megaspore now enlarges, giving rise to the two, four and eight celled embryo-sac in the usual manner (Figs 4, 5, 6, 8) In the four-celled stage the nuclei are approximately equal in size In the eight-celled stage the synergids are very large and pear-shaped, and at least one persists until a very late stage in the development of the embryo (Figs. 9, 10, 12, 13, 14, 16, 18). The egg is slightly larger than the synergids and very similar in appearance ; while the polar nuclei are comparatively large (Figs 6, 7). The antipodals are somewhat smaller and cut off from the sac by delicate but definite walls (Fig. 6), and always occupy about the same relative position to each other.

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* Contributions from the Botanical Laboratory of Ohio State University X.

The antipodals are absorbed very early (Fig 8) and the sac enlarges very rapidly especially from the antipodal end forming almost a complete circle and enclosing a mass of the basal cells of the nucellus in the center of the camphylotropous ovule Fig 22) The first division of the endosperm occurs at about the same time as the first division of the embryo After that it divides very rapidly forming the typical peripheral endosperm* lining the embryo sac (Fig 16) At the antipodal end of the sac the endosperm is always more dense than in other parts of the sac (Fig 17) and probably makes the absorption of the nucellus more rapid The micropyle and the pollen tube (Fig 16) were very clear in many preparations but the act of fertilization was not observed However several cases were observed which indicated that the second sperm nucleus might unite with the two polar nuclei but were not sufficiently clear to draw a conclusion

EMBRYO

The fertilized egg divides by transverse walls to form three or four cells in an axial row (Figs 9 12) Typically the row consists of three cells developed in acropetal order The upper of these cells next divides by a longitudinal wall (Fig 10) This is followed by a similar division in the next lower cell (Fig 11) The two upper cells now divide by longitudinal walls at right angles to the first thus forming a quadrant (Fig 12) In the meantime one or more transverse walls have been formed in the basal cell thus lengthening the suspensor The embryo proper is now usually composed of three or four tiers of cells (Figs 13 14 15) Each tier of cells divides first longitudinally and then more or less irregularly by both transverse and longitudinal walls forming an embryo almost spherical in shape but slightly larger on the side away from the funiculus (Figs 13 14 15 16 18) The protoplasm in the upper two thirds of the embryo is usually more dense than in the lower one third (Fig 16)

The suspensor originates as a single cell (Figs 9 12) This cell usually divides by the formation of transverse walls (Figs 13 14 16) but occasionally divides by longitudinal walls (Fig 15) The formation of transverse walls is followed by a longitudinal division in either one or both cells (Figs 16 18) After this it was impossible to follow the divisions However it always remains short but becomes very much widened (Fig 19) as a result of longitudinal division By the time the embryo has reached three-fourths full size the suspensor has usually disappeared (Fig 20)

The cotyledons originate from opposite points of the almost spherical embryo (Fig 18, c c) The outer of these two points grows very rapidly and gives rise to the very large cotyledon (Fig. 19). This cotyledon grows very rapidly and curves into almost a complete circle (Fig. 22). The inner point of growth makes very little increase in size and forms the inner rudimentary cotyledon, which now appears as a small projection almost at right angles to the large cotyledon (Figs 19, 20, 21)

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* Hegelmaier Dr Untersuchungen ueber die Morphologie der Dicotyledonen Endosperms Nova Acta d K L C D Akad d Naturforscher 49 1885

The plumule originally stands at the upper end of the axis of the embryo (Fig 18), but with the development of the large cotyledon it is pushed to one side, so that in the older stages it appears as a lateral plumule (Figs 19, 20, 21)

The development of the calyptrogen begins in the dermatogen and in the cells just above the suspensor (Fig 19*a*), and gradually extends across the tip of the embryo The root cap is formed in the usual manner, by transverse division of cells in this layer, and about this time the suspensor begins to disappear

SUMMARY.

1. Normally four megaspores and two tapetal cells are formed, the lower megaspore cell forming the embryo sac in the usual manner.

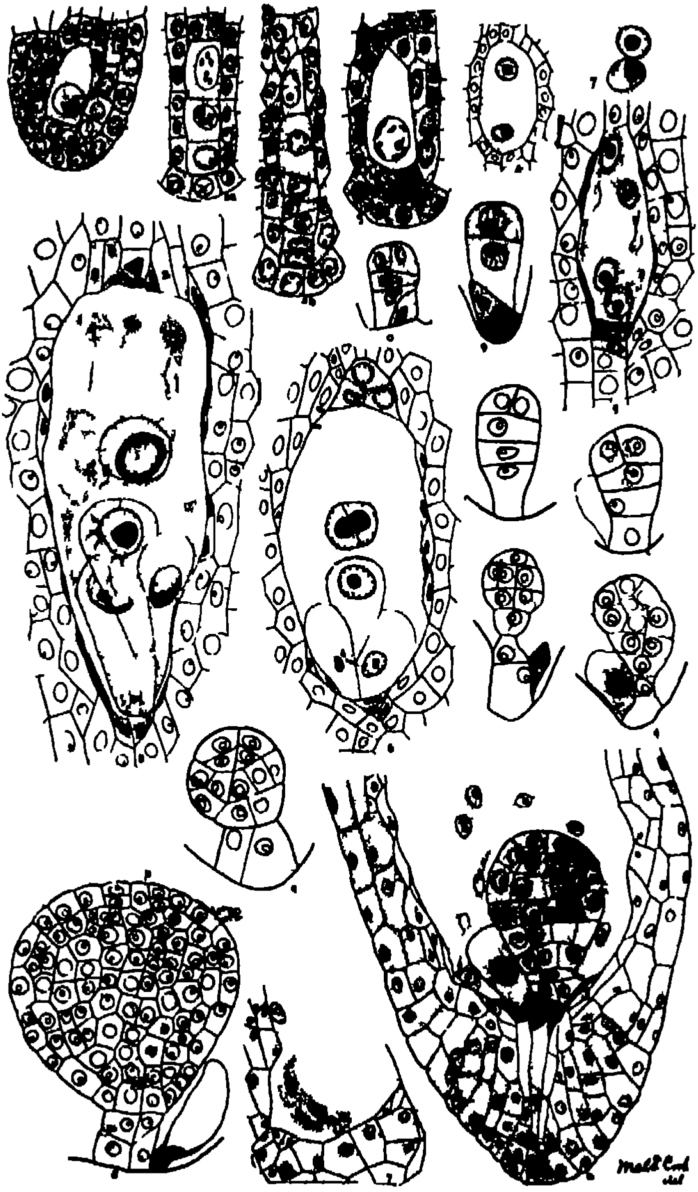
2. The first five or six divisions in the formation of the embryo are quite regular, but the succeeding divisions are very irregular.

3. The suspensor is at first filamentous, but becomes massive by longitudinal divisions It does not contribute to the formation of the tissues of the root-tip.

4. Only one cotyledon develops and it becomes very large; the other cotyledon remains rudimentary and gives the mature embryo the appearance of a monocotyl.

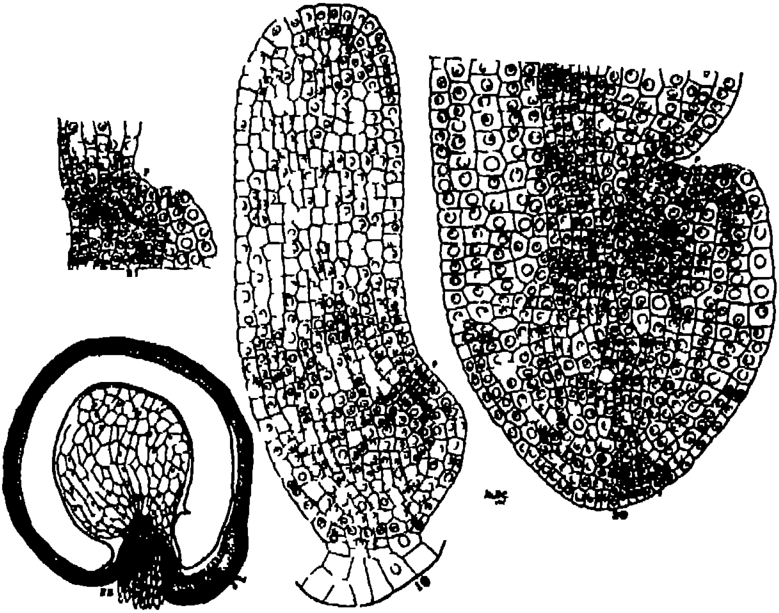
I wish to express my thanks to Professor J. H. Schaffner, of the Ohio State University, for valuable suggestions in the completion of this study. I also wish to express my thanks to three of my former students in DePauw University, Mr. J. W. Little, Miss Nellie Inwood and Miss Helen Powell, for valuable material and preparations.

OHIO NATURALIST *Plate 5*



Cook on Claytonia virginica.

OHIO NATURALIST *Plate 5a*



Cook on Claytonia virginica

EXPLANATION OF FIGURES

In the drawings Leitz stand and a B and L camera lucida were used. Figs 1 to 8 a No 6 Zeiss ocular and a 1-12 B and L immersion; in Figs 9 to 21 a No 6 Zeiss ocular and a No 7 Zeiss objective. In Fig 22 a No 4 Leitz ocular and a No 5 Leitz objective.

Fig 1 Archesporial cell and two tapetal cells
2a One tapetal cell and beginning of the second division in the formation of the megaspores
2b Four megaspores and three tapetal cells
3 Functional megaspore
4 Two-celled sac
5 Four-celled sac and tapetal cells
6 Eight celled sac showing conjugation of polar nuclei. Also the three antipodal cells just before disorganization
7 Polar nuclei approaching
8 Eight-celled sac after conjugation of polar nuclei. First stage in absorption of nucellus from antipodal end of sac
9 Two-celled embryo and persistent synergid
10 Four-celled embryo and persistent synergid
11 Six-celled embryo
12 Eight-celled embryo and persistent synergid
13 Embryo
14
15 with longitudinal wall in first suspensor cell
16 and persistent synergid. Also endosperm
17 Antipodal end of sac showing massing of endosperm (about same age as in Fig 16)
18 Spherical embryo and persistent synergid. c cotyledon, p plumule
19 Embryo showing suspensor, c cotyledons (one large and one small), p plumule and formation of calyptrogen (a) above suspensor
20 Base of large embryo showing plumule (p), rudimentary cotyledon (c) and root cap (r)
21 Part of embryo showing rudimentary cotyledon (c) and plumule (p)
22 Entire ovule showing mature embryo with large cotyledon curved around a central mass of nucellus cells which are rich in starch. a outer integument, b inner integument, end. endosperm

LIFE-HISTORY NOTES ON TWO FULGORIDÆ.

OTTO H SWEZEY.

I. *Amphiscepa bivittata* Say.

August 1, 1902, while sweeping with the insect net amongst tall grass, wild balsam and other weeds, at Cedar Point, Sandusky, Ohio, several immature insects were secured, that later proved to be the larvæ of Amphiscepa bivittata Say. One adult was discovered upon a grass blade within one-fourth inch of the exuviæ of one of the larvæ, and it looked fresh, as though it had but recently assumed its mature form. Several larvæ were taken home alive and placed upon grass in a bell-jar; and within a week they had all transformed to the adult stage, thus proving the identity of the larvæ; in fact, I was so fortunate as to observe one specimen in the act of moulting, on the morning of August 4th.

August 2d and August 8th larvæ were taken from golden rod and other weeds along a hedge fence enclosing a clover field, about three miles southeast of Sandusky, but none were taken later than that date, adults were taken in considerable numbers, however.

Few specimens were found at rest on the plants, but from the ones that were found, it would seem that they habitually perch upon a stem just below the base of a petiole (VI-5), and there puncture the stem to secure the sap for food In this position they have some resemblance to the tufts of hairs often found at base of petiole or in the axil. They are very active when disturbed, leaping about as suddenly as the adults do, but may often be secured by quickly putting the mouth of the killing bottle over them before they leap.

DESCRIPTION OF LARVA.

Length 4 mm.; breadth 2½ mm.; back very convex, so that height nearly equals breadth; general color whitish with brown markings, head broad, nearly straight across in front, slightly incurved in middle, prominent marginal carina in front of eyes; vertex twice as broad as long, whitish, with a median darker stripe; frons darker at base, some white dots in this darker area, a row of dark-centered pustules near each margin, clypeus and beak dark brown, eyes pale brown with a few lighter areas; first segment of antenna very short, second segment subglobose, bristle black, enlarged at base; peronotum slightly shorter than vertex, broader behind the eyes, ~~white~~ median carina, bordered on each side with a darker stripe, which is a continuation of the median stripe of vertex, and extends the whole length of thorax and abdomen; a dark brown spot on pronotum behind the eye, remainder of pronotum whitish, nearly covered with black-centered pustules; mesonotum twice as long as pronotum, whitish, dotted with black, a dark brown area at base of wing pads, at each outer anterior part is a rounded elevation covered with black-centered pustules, a similar elevation on the outer posterior part of the metanotum; metanotum slightly shorter than mesonotum; wing pads greenish, with some traces of veining and some brownish markings, projecting slightly beyond the metanotum; abdomen short and thick, seven segments, whitish, with light brown markings the brown areas dotted with white, a dark-centered pustule on each side and somewhat removed from median line in segments 3, 4 and 5, similar pustules on the sides of segments 2, 3, 4, 5 and 6, four on the end, four on the 3rd, three on the 4th, two on the 5th, and one on the 6th, a brownish area in the region of these lateral pustules, segments 3, 4, 5 and 6 have a yellow spot on the tergum on each side, about midway between median line and margin, somewhat nearer to the margin; ventral side of abdomen white, first and second femora and tibiae banded, brown and white, posterior femora brown, white at knee; posterior tibiæ brown, with lighter stripes, three spines on outer edge (wanting in the adult), one large and six smaller spines at apex, some green in tibiæ and tarsi, hind tarsus three-jointed, first joint wide, with four spines at apex, third joint with two hooks

The coloration varies, some specimens with more brown than others, and in some the wing pads are greener

Abdomen covered with a white, thread-like, cottony secretion, which at the tip of abdomen is formed into a tuft, a pair of similar tufts on metathorax, and another pair on mesothorax This material is very easily rubbed off in the insect's movements, or in being handled It gives to the insect a protective resemblance to tufts of hairs on leaves or in the axils of petioles

II *Ormenis septentrionalis* Spin.

Four larvæ of this species were collected, August 4, 1902, from a hedge fence composed of various kinds of shrubs, and bordering one side of a clover field, in the vicinity of Sandusky, Ohio They were on the underside of crumpled leaves of the dogwood (*Cornus asperifolia*). Each one was on a separate leaf, situated in a depression between crumpled folds, and was covered over so as to be almost hidden by the white cottony secretion of wax from its abdomen (Fig. 10*a*) Some of this substance was also spread around on the leaf, upon an area having a radius of one-half inch to one inch from the insect. It is probable that the crumpled nature of the leaf was the result of its being punctured by the insect in feeding It seems evident that, unless disturbed, they remain upon the same leaf throughout the larval period, for leaves were found which had two and sometimes three exuviæ situated on the places where the insects had been feeding, as shown by the presence of the cottony substance

A dozen or more adults were taken from the bushes in this same locality. One specimen, still soft and fresh, was found on a leaf near the exuviæ of a larva amidst its cottony surroundings About two dozen leaves were found having the cottony substance and the exuviæ of larvæ. These were mostly dogwood leaves, only one being red oak, one hawthorne, and two were prickly ash leaves.

On the following day, however, examining a different part of the same hedge, exuviæ were found more abundantly on leaves of the climbing bittersweet (*Celastrus scandens*) A few larvæ were taken on bittersweet leaves, also. As before stated, the larvæ evidently remain in one location, that is, upon the same leaf for quite a period of time. but when disturbed they move about, and frequently in attempting to capture them they would make a sudden leap, as all of this family of insects are in the habit of doing

August 7th, exuviæ were found abundantly upon wild plum leaves, and a few on leaves of wild grape From these observations it is evident that this species has quite a variety of food plants, the larvæ and exuviæ having been found on climbing bittersweet, dogwood, plum, grape, prickly ash, red oak and hawthorne, most abundantly on the first mentioned and in less numbers on the others, in the order named

Several visits were made to this particular hedge, and I was always rewarded by the capture of several adults and an occasional larva, but search upon other similar hedges of the vicinity failed to yield a single larva or show evidences of their having been there, although an occasional adult was taken

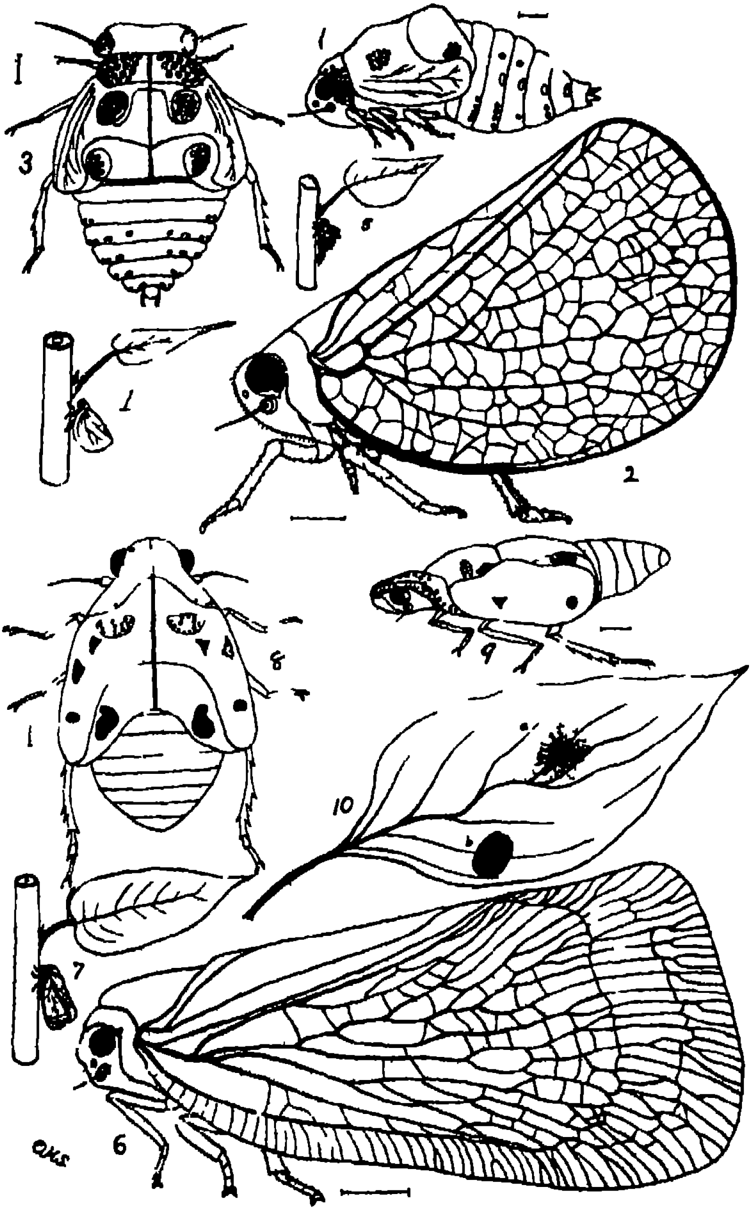
DESCRIPTION OF LARVA

Length 4.5 mm, width, 2.5 mm, somewhat depressed, only about one-third as thick dorso-ventrally as laterally, a very pale green, even to whitish, head narrow, projecting slightly beyond eyes, rounded in front, above covered by the pronotum, frons broad, three carinæ, margin extending laterally slightly in front of eyes, eyes pinkish brown; ocelli wanting, antennæ cylindrical, first segment shorter than the second, bristle brown, enlarged at base, pronotum produced forward, covering the head, deeply emarginate behind, the angle rounded, whole pronotum covered with black pustules having lighter centers, or many entirely black, mesonotum has two convex pustule covered areas, one on each side between median line and wing pads, a median groove extends the length of thorax, most pronounced on the mesothorax, wing pads extending to the third abdominal segment; each fore wing pad has two triangular black patches near base and a rounded black patch near apex, a large black patch on hind wing pad; these black patches are not always prominent, and vary in size, shape and position, legs pale green, posterior tibiæ with three spines on outer edge and a large one at apex, also six smaller apical spines, tarsi three-jointed; feet brownish, and the tibial spines tipped with brown; abdomen covered with a white filamentous waxy secretion, which at the tip of abdomen is in tufts, this secretion is produced in such abundance as to entirely cover the insect when feeding upon the surface of a leaf, and thus serves as a protection on account of its resemblance to a bunch of spider web or a tuft of cottony hairs upon the leaf

EXPLANATION OF PLATE.

Figs 1-5 Amphiscepa bivittata Fig. 1—Adult on stem, natural size. Fig. 2—Adult, x 10 Fig. 3—Larva, dorsal view, x 10 Fig 4—Larva, lateral view, x 10 Fig 5—Larva on stem, natural size. Figs. 6-10—Ormenis septentrionalis. Fig 6—Adult, x 10. Fig. 7—Adult on stem, natural size Fig 8—Larva, dorsal view, x 10 Fig. 9—Larva, lateral view, x 10 Fig 10—*a*, Larva on leaf, natural size, *b*, Cocoon of a parasite that infests the larva of this species

OHIO NATURALIST *Plate 6*



SWEZEY on Life History Notes on Two Fulgoridae

ADAPTABILITY IN FERNS.

W. E. WELLS

A few years ago while making a collection of Licking County, Ohio, ferns, the idea of starting a fernery suggested itself. A few of the common species had already been planted on the north side of the house. To these more were added until a large number of the ferns of the country and some from distant localities were making themselves at home in the door-yard

The house mentioned is at Granville, being built on the hill-side and standing upon a terrace. The north side of the house faces the bank which was made in cutting down to the terrace. There is a space from six to eight feet wide between the house and bank. The rain-wash is carried off by a ditch at the base of the bank Only a few inches of the foundation of the house show above the ground The kitchen being narrower than the main part of the house, an angle is formed In this angle and all along the entire length of the building the ferns are planted The excavated bank, the north exposure and the angle in the house, combine to furnish the conditions favorable for ordinary fern growth Shady conditions do not, however, prevail throughout the entire day For during most of the year the morning and afternoon sun shines along the north side of the house, from one to four hours a day; the remainder of the time it is quite shady, and yet there is no noticeable moisture

The method used in planting was to put the large, tall species next to the house, and the smaller ones further forward The soil was enriched occasionally and a little sand was also added. In the driest summer months the ferns were watered occasionally, but beyond this they have received but little attention At present they are all in flourishing condition. Only one has been lost, Polypodium vulgare It did well at first but died about six months after it was transplanted

Propagation has been very active in many of the species. In fact some have spread so rapidly as to endanger their less thrifty neighbors. In such cases a weeding-out process became necessary.

A few of the members of this unique colony deserve special mention Asplenium ruta-muraria was transplanted from the top of an isolated limestone rock in Clifton Gorge, Greene County, and is growing well in the totally different soil and surroundings. Osmunda regalis was taken from a pond situated in a dense wood. The roots and stems formed a large hummock in the center of the pond. About a cubic foot of the root-mass was taken with the fronds for transplanting. In its new environment it has had comparatively little moisture, yet it grows quite vigorously. Pellaea was taken from a crevice in the rocks, where there seemed to be no soil whatever; now it lives in the drift soil with apparent ease. Camptosorus was taken from the face of a cliff where it invariably grows. Now it is growing flat on the ground and has spread considerably by its peculiar method of leaf rooting.

The fact that these ferns, many of which live under peculiar conditions, should flourish under one and the same environment with but little of human control, certainly shows a remarkable power of adaption.

The question might well be asked: What would become of these ferns if left entirely to themselves? From what has already been stated with regard to the rapidity of propagation in some of the species, it would seem that those that find here their normal habitat and those that can most readily adapt themselves to the new conditions would eventually choke out the weaker species. It is interesting to note in this connection that among those which have shown a decided tendency to spread, Cystopteris bulbifera, Dryopteris thelypteris and Phegopteris dryopteris have been troublesome.

A list of ferns which were transplanted is given below. A few of these were brought from a distance. In such cases the localities are given opposite the names.

1. Botrychium virginianum.
2. Botrychium lunaria.
3. Osmunda regalis.
4. Osmunda cinnamomea.
5. Osmunda claytoniana.
6. Onoclea sensibilis.
7. Onoclea struthiopteris—Brevoort Lake, Mich.
8. Cystopteris bulbifera.
9. Cystopteris fragilis.
10. Dryopteris acrostichoides.
11. Dryopteris thelypteris.
12. Dryopteris cristata.—Brevoort Lake, Mich.
13. Dryopteris marginalis.
14. Dryopteris spinulosa var.—Walter's Park, Pa.
15. Dryopteris spinulosa var.—Walter's Park, Pa.
16. Phegopteris hexagonoptera.
17. Phegopteris dryopteris—Brevoort Lake, Mich.
18. Camptosorus rhizophyllus.
19. Asplenium pinnatifidum.
20. Asplenium platyneuron—Walter's Park, Pa.
21. Asplenium trichomanes.
22. Asplenium angustifolium.
23. Asplenium ruta-muraria.—Clifton Gorge, O.
24. Asplenium acrostichoides.
25. Adiantum pedatum.
26. Pteris aquilina.
27. Pellaea atropurpurea—Clifton Gorge, O.
28. Polypodium vulgare.

Antioch College.

OHIO REPTILES AND BATRACHIANS *

MAX MORSE

The group of reptiles and batrachians offers a striking example of a case where a little learning is a dangerous thing No dependence can be placed in the records of the casual observer—not that he is always willfully erroneous but there are so many ways in which one can make mistakes in identification of these forms that he only is to be trusted to a degree of certainty who has given some attention to the technicalities of the subject The ordinary observer groups all snakes into either poisonous or non poisonous and to the latter he gives the name of nuisances never thinking that this group of non poisonous reptiles can be divided into beneficial and non beneficial To the farmer who of all of us comes into closest contact with the reptiles and batrachians a knowledge of their good or evil is an important thing To my mind the economical importance of these two groups is not to be ranked below that of birds

For such reasons I consider that a systematic survey of the reptiles and batrachians of the State should be made In other States this need is being recognized and in New York Edwin C Eckel late of the University of the State of New York has published an excellent State list which places the knowledge of these forms on a par with that of birds In Ohio the fishes are already in most excellent condition and soon the birds will be likewise The remaining three groups batrachians reptiles and mammals —are still to be worked up

The first attempt at a State list was that of Dr Jarred Potter Kirtland in the First Geological Survey of the State published in 1833 In it he includes twenty seven species of reptiles and twenty one of batrachians In the introduction he makes the remark that no important additions to the class of reptiles can be made No list was published after this one of Dr Kirtland s until 1879 when Dr Smith of Ann Arbor Mich gave the list in the fourth volume of the Survey under Dr Newberry In this list he enumerates thirty seven species and sub species of reptiles and twenty five of batrachians—this making an addition of ten species of reptiles and four batrachians to Dr Kirtland s list This list—the last general list for the State was written by a man who had to obtain his information from the list of Dr Kirtland and what reports were furnished him by residents of Ohio No exact records are given as to the occurrence and distribution of the forms except in a few cases

Mr E V Wilcox then assistant in the Ohio Experimental Station published a list of the batrachia of Ohio in the *Otterbein*

Read before the Ohio State Academy of Science Nov 1901 Columbus O

Argus for April 1891 The paper is based on personal work in several parts of the State and on the material in the museums of the State University and the State Experimental Station Several species of which Mr Wilcox was uncertain as to identification were submitted to the late E D Cope and hence bear the stamp of high authority This Experimental Station collection is at present in the State University Museum

Those in charge of several of the museums of the State have been so kind as to furnish me lists of the specimens in these museums bearing Ohio labels I have gone over the two monographs of E D Cope The Crocodiles Lizards and Snakes of North America published in the Annual Report of the United States National Museum for 1898 and The Batrachia of North America being Bulletin 34 of the same institution Several records are given there of the occurrence of these forms that are additions to the other lists

From all sources I have found thirty four batrachians and fifty one reptiles recorded for the State Several more could be included from less certain sources but this number includes only those that have been published or are in the several museums of the State There are many doubtful species which are said to occur in certain localities and only collections made in such regions can settle the questions at issue The true moccasin of the South has been reported from the southern part of Ohio Such is possible but it is very easy to confuse this poisonous reptile with Natrix faciata sipedon

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ON DISCELIUM NUDUM Bridel

— EDO CLAASSEN

This moss which is supposed to be very rare in the United States was found by me in six localities in Cuyahoga county always on the north side of ditches river banks or steep moist embankments adjoining country roads or railroads Although of a very small size (barely that of a pin) its presence on the clayey soil may be easily ascertained in the fall of the year by its yellowish green protonema Many thousands of individuals were observed in several localities the protonema covering many square feet often with no less than 300 specimens to the square inch In October the moss plants have several small scales and a short wire like setæ with here and there the beginning of the capsule In April the plants are about an inch long and the capsules are nearly full grown while there may be no ripe capsules before June

Cleveland Ohio

AN ENUMERATION OF THE PLANTS GROWING ON A BIG ERRATIC BOULDER.

EDO CLAASSEN

The valley of the Rocky river abounds in erratic boulders, a small number of which represent the limestone of the Lake Erie islands and the balance the granite, etc., of the Canadian highlands. The largest among the latter is found on the bottom of a creek flowing into a river which empties into Lake Erie.

The boulder in question is of the granite type, almost spherical in shape, and has a diameter of seven feet. While a large portion of its surface is vertical or too smooth to allow any vegetation to grow, there are many places that furnish the necessary substratum for the spores or cells of various cryptogams to germinate and develop. Sufficient moisture during the greater part of the year and a shady locality, now and then penetrated by the sun's rays, have no doubt exercised no small influence on the growth of this boulder flora.

All plants occuring on the boulder are cryptogams. Besides one alga they represent the following species, of which only those marked with an X were found in a fruiting condition:

LICHENS

1 Cladonia pyxidata (L.) Fr.
2 Lecidea albo-coerulescens (Wulf.) Schaer. X
3 Leptogium tremelloides (L.) Fr.
4 Parmelia caperata (L.) Ach.
5 Parmelia saxatilis (L.) Fr.
6 Peltigera canina (L.) Hoffm.

LIVERWORTS

7 Lophocolea heterophylla Nees.
8 Metzgeria myriopoda Lindb.
9 Porella platyphylla Lindb.
10 Radula complanata Dumort. X

MOSSES

11 Dicranum fulvum Hook.
12 Hedwigia ciliata Ehrh. X

TOWNSHEND HALL

The Club met in Townshend Hall in order to avail itself of the lantern. Prof. Osborn gave the address of the evening on "The Achievements of Economic Entomology." He outlined the methods based on superstition which were formerly used to free a country from insect pests. The losses due to insects are extremely large but probably underestimated. He gave then brief descriptions illustrated by lantern slides of many of the most destructive insects and gave accounts of methods of dealing with them. He then spoke of the beneficial insects, the domesticated forms, the bee and the silk worm. He concluded by emphasizing the dependence of economic Entomology on other sciences.

Mr. Sweezy was elected to membership.

ROBERT F. GRIGGS, *Secretary*.

The Ohio Naturalist,

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OPPORTUNITIES FOR FAUNAL STUDIES AT THE LAKE LABORATORY AT SANDUSKY.*

HERBERT OSBORN

It is my desire to call attention to the rather exceptional opportunities for pursuing faunal studies in the vicinity of Sandusky, which are made much more available by the location of a summer laboratory or biological station at that point. The laboratory was located there by Professor Kellicott some years ago and the wisdom of this selection has been amply demonstrated by the wonderfully rich fauna which is found in the water and upon the various areas of land in that vicinity. So far the work has not been carried on so exhaustively as to complete the study of any one group of animals, although considerable progress has been made in certain lines. Professor Kellicott's studies were particularly devoted to Rotifera and in two or three papers on the "Rotifera of Sandusky Bay" he presents the result of his collecting in that group. The Protozoa have been studied during the past year by Professor F. L. Landacre and his preliminary report upon this group showing 125 species will indicate the richness of the Protozoan fauna. The fishes have been collected and probably most of the species are already recognized. The study of the birds is considered as having been fairly complete. For the reptiles some work is being done and this group will doubtless be worked up within a few years. Many insects have been listed, over sixty species of Odonata having been recognized so far, but doubtless other forms are to be found, especially if the collections were extended over other months of the year. Some records of Hemiptera have been made, but they cannot be considered as in any way exhaustive at the present time. Extensive collections have been made of the Diptera by Prof. J. S. Hine, but no record as yet is published.

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*Presented before the Ohio Academy of Science, Nov. 28th, 1902

It will be seen from this that scarcely anything has been done in the way of exhaustive study of any one of the groups of worms, crustaceans, mollusks, and a great majority of the groups of insects, in all of which we may be sure that there is an enormous aggregate of species represented.

It appears to me that a systematic survey of the locality is not only possible but that with the large number of students visiting the locality each year we may hope for rapid progress, provided there is definite cooperation to that end. With regard to the value of such studies, we may say that the locality possesses some very unique features and is an exceptionally fine locality for flora, as has been shown by Professors Moseley, Kellerman and others. Many peculiar occurrences of animal groups have been noted that will greatly extend the main distribution of many of the species To those familiar with the region it is unnecessary to speak of the peculiar and varied conditions presented, but for those who have never visited the locality it will be proper to state that the remarkable conditions are due largely to the presence of an extended stretch of sand—Cedar Point, which extends from six to seven miles and encloses the east arm of Sandusky Bay. This Point is virtually an extended sand dune, or series of dunes, with a flora entirely characteristic of sand dune formations, that the arm of the Bay it encloses is to a considerable part an extended marsh so closely enclosed by islands, points and vegetable growth that the waters are very largely undisturbed.

Within the other arm of the Bay we have the outflow of Sandusky River and a more or less rocky shore with limestone soil, which contrasts strikingly with the sand formations of Cedar Point. Another striking condition is offered in the level prairies in the vicinity of Castalia. On the whole there is, within a radius of five miles of the city of Sandusky, a variety of conditions which it would be hardly possible to duplicate anywhere in the interior of the United States, and which makes possible a great variety of biological studies

I may add that it is the purpose of the University to develop the biological station, and to this end it desires to make the station accessible and useful to every biological student and especially those who are connected with the colleges and schools of Ohio.

The members of this academy particularly should feel a sense of proprietorship in the station and are most cordially invited to take advantage of its opportunity.

THE DEVELOPMENT OF THE EMBRYO-SAC AND EMBRYO OF AGROSTEMMA GITHAGO.*

MELVILLE THURSTON COOK.

Agrostemma githago L. was selected as a plant for comparison with Claytonia virginica, they usually being placed in the same order but in different families.

The ease with which the material can be prepared and the regularity of the development of the embryo-sac and embryo make it a very desirable plant for study.

METHODS.

The material was killed and fixed in Flemming's solution and in chromo-acetic, passed through the alcohols, imbedded in paraffin, cut on a Minot microtome and stained in aniline safranin and gentian violet, and also in Hadenhaine's haematoxylin and iron alum For the development of the embryo-sac the safranin and gentian violet combination was most desirable, but for the development of the embryo either stain was satisfactory.

The young buds were killed entire, but the sepals and petals were removed from the older ones. In the very youngest stages it is desirable to cut the sections thin, but when the embryo-sac has reached the eight-celled stage it must be cut thick, otherwise important structures may be lost. The orientation was very simple ;- by cutting the ovaries transverely the sac will be cut longitudinally.

The archesporium may originate as one, but more frequently as two or three, hypodermal cells (Figs 1, 2, 3). These increase in size (Fig 2), and one eventually absorbs the others. Many specimens were examined, but in all cases only one cell developed into an embryo-sac. This single archesporial cell now divides by transverse divisions into three cells, of which the lowest develops into the functional megaspore (Fig. 4) The two (Fig. 5), four (Fig 6), and eight (Fig. 7) celled stages of the embryo-sac are formed in the usual manner. The sac increases in size very slowly up to this time, and the nuclei of the sac are of practically the same size (Figs. 6 and 7), except that antipodals are slightly smaller than the other nuclei.

After the formation of the megaspore the ovule begins to enlarge, and a very pronounced growth of the nucellus and integuments on the micropolar side projects from the micropyle. The embryo-sac is thus left deeply imbedded in the nucellus (Figs. 4 and 23). By the time the sac has reached the two-celled stage the nucellus shows two well-defined zones (Figs. 5 and 23). The inner zone surrounding the sac is made up of thin-walled cells, which degenerate for the enlargement of the sac which occupies the entire inner zone in the eight-celled stage (Fig. 7). The walls of this inner zone were so delicate that it was difficult to get good preparations of the eight-celled stage. The outer zone is made up of thicker walled cells, which are more permanent and which are in more or less regular rows, which radiate from the inner zone. The inner zone is connected with the micropolar end of the ovule by two or three rows of elongated cells, which degenerate to form the path for the pollen tube (Figs. 5 and 23). After fertilization the part of the nucellus projecting through the micropyle degenerates and the integuments come together at that point.

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* Contribution from the Botanical Laboratory of Ohio State University. XI.

Lyon* describes an enlargement of the ovule similar to that in Euphorbia corollata, except that there is no zone-like structure, and the cells which break down for the passage of the pollen tube are larger and looser than the surrounding tissue.

After the conjugation of the polar nuclei the sac enlarges on one side and at right angles to its long axis (Fig. 24). The endosperm nucleus passes down into this pocket, divides and eventually forms a peripheral endosperm (Fig. 18). One case was observed where the endosperm nucleus had failed to divide, although the embryo was in its five-celled stage. At the lower end of this newly formed pocket a mass of endosperm is formed, which probably hastens the absorption of the nucellus at that point (Fig. 19). At this time the egg has enlarged considerably, the synergids remain about the same size and disappear very early; in only one case was a synergid observed to persist until after the formation of the first transverse wall in the embryo By the enlargement of the sac in the new direction the antipodals are left in a small pocket (Fig. 24*a*); they degenerate, sometimes by fragmentation, and eventually disappear.

The pollen tube was observed a number of times, always following the canal formed by the absorption of the cells previously described, but in no case was I able to observe the act of fertilization.

EMBRYO.

The fertilized egg divides by transverse wall, the lower cell enlarging into a large basal cell (Fig. 8). The upper cell now divides by transverse division (Fig. 9). This is followed by a series of transverse divisions, the order of which I could not determine, resulting in a filamentous embryo of five, six or seven cells, with one large basal cell (Figs. 19, 11, 12). When the embryo has reached this condition the cell next to the upper cell divides by a longitudinal wall (Fig. 13). The cell next below now divides in a similar manner, while the two cells next to the top divide again so as to form a quadrant (Fig. 14). The upper cell is the next to divide by a longitudinal wall (Fig. 15), and this is followed by a division of the fourth cell from the top (Fig. 16). Repeated longitudinal divisions now result in the spherical embryo made up of five tiers of cells (Figs, 17, 18, 20). In the meantime the suspensor has elongated by transverse divisions, but the large basal cell remains unchanged (Figs. 18, 20, 21, 22).

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* Florence May Lyon A Contribution to the Life History of Euphorbia corollata. Bot. Gaz. 25, 6 1898 pp. 418-426.

This spherical embryo now enlarges by both longitudinal and transverse divisions in the different tiers until the appearance of the cotyledons, when it begins to elongate (Figs. 21, 22 and 25).

The cotyledons develop in the typical dicotyl manner on opposite sides and at the summit of the spherical embryo, and with the plumule between. At the same time the calyptrogen begins to develop in the row of cells next to the suspensor, giving rise to a well-developed root-cap The embryonic tissues are quite distinct; the dermatogen, periblem and plerome being easily recognized. At about this time the suspensor disappears, and the embryo elongates and becomes very much curved in the embryo-sac, the inner cotyledon being slightly shorter than the outer one (Fig. 26).

It will be easily seen that there is very little similarity between the development of the archesporium, the ovules or the embryo of Agrostemma githago and Claytonia virginica, the embryonic development being entirely different The embryo of A. githago resembles in general appearance the embryos of Cruciferae as represented by Capsella and Alyssum.

I wish to express my thanks to Prof. J. H. Schaffner, of the Ohio State University, for many valuable suggestions in this study.

CONCLUSIONS.

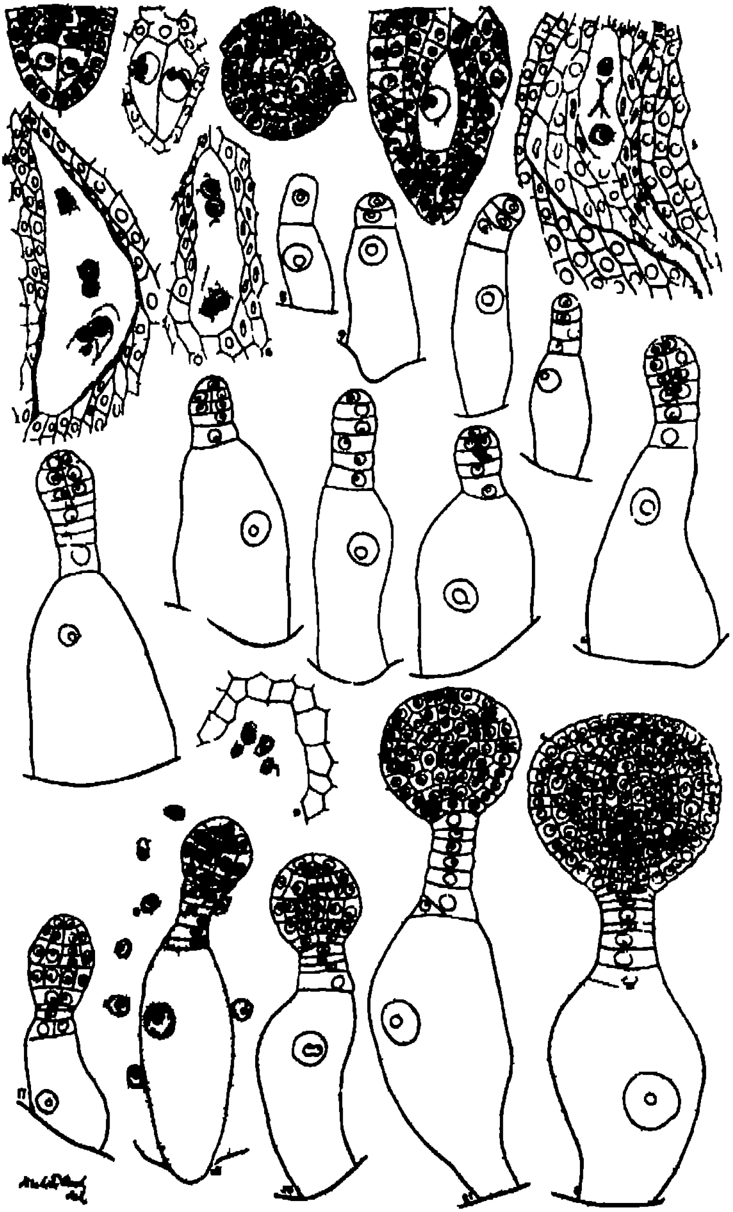
1. The archesporium develops as one, two or three cells, of which all but one are absorbed.

2 The sac is formed from the one remaining archesporial cell in the usual manner. After the formation of the eight-cell stage, the enlargement of the sac is from one side and at right angles to the original long axis

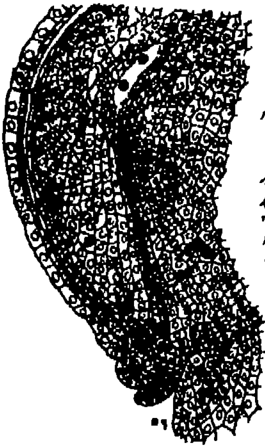
3. With the formation of the sac, the ovule enlarges from the micropylar end, thus leaving the sac deeply embedded in the nucellus. A short beak is formed, which projects through the micropyle. Two or three rows of cells degenerate to form a passage for the pollen tube.

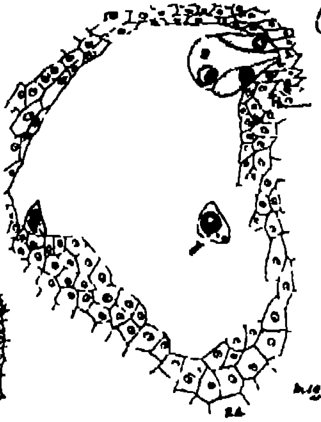
4. The embryo is at first filamentous, the basal cell being very large. The four or five cells next to the apex divide longitudinally, forming the four or five tiers of a large spherical embryo. The cotyledons and the root-tip are formed in the usual dicotyledonous method. Soon after the appearance of the cotyledons the suspensor degenerates.

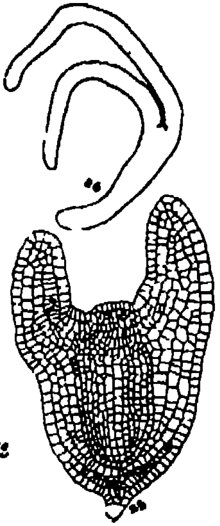
OHIO NATURALIST *Plate 7*



COOK on Agrostemma githago







EXPLANATION OF FIGURES

For the drawings a Leitz stand was used For Figs 6 to 7, a No 6 Zeiss ocular and a 1-12 Bausch and Lomb oil immersion, for Figs 8 to 24, a No. 6 Zeiss ocular and a No 7 Leitz objective

Fig 1 Two archesporial cells
" 2 " " "
3 Three " " in cross section (slightly oblique)
4 Functional megaspore
5 Two-celled embryo sac and inner zone of nucellus.
" 6. Four- " "
" 7 Eight " " inner zone of nucellus nearly absorbed
" 8–12. Series of embryos showing transverse division
" 13 Embryo showing first longitudinal division
" 14 " second and third longitudinal divisions
" 15 " " fourth " "
" 16 " " fifth " "
" 17 " of five tiers of cells and suspensor
" 18 " " " " also endosperm.
" 19 Mass of endosperm in basal pocket of embryo sac
" 20 Spherical embryo of five tiers of cells
" 21. " "
" 22. " " showing origin of cotyledons (c).
" 23 Ovule showing the two-celled embryo sac, the two zones of the nucellus, the radiating arrangement of the cells of the nucellus, the path to be followed by the pollen tube, and the two integuments.
" 24. Embryo sac enlarging at right angle to the long axis; e, egg and synergids, a, antipodal end, endosperm
" 25. Embryo showing the differentiation into cotyledons, calyptrogen, dermatogen, periblem and plerome
" 26 Diagram of mature embryo.

ATAVISM IN THE WATERMELON

JOHN H SCHAFFNER

In the summer of 1895 I noticed a peculiar variation in the leaves of a watermelon vine growing in a patch in Clay county Kansas The plants were of the variety known as the Georgia Rattlesnake and excepting the single plant mentioned were of the usual type

The leaves of the watermelon seem to be quite constant in form They are usually described as palmately five lobed the lobes being mostly sinuate pinnatifid with all the segments obtuse (Fig 1*b*) But in this plant the lobed condition of all the leaves was almost entirely absent the border being only moderately undulate (Fig 1*c*)

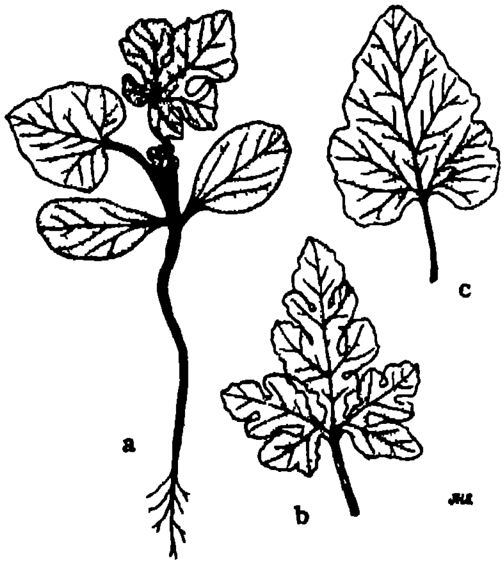


Fig *a* A young seedling of the usual form
b Leaf of usual form
Leaf of special form

Some of the seed from this individual were planted in 1896 and the same leaf peculiarity was reported The form has been successfully cultivated every year since that time although it was usually planted in patches with the ordinary kind and much cross pollination must have resulted

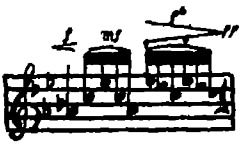
Whether this condition of entire leaves is common in the watermelon I do not know but I regard it as a good example of atavism or reversion to a more primitive type Such reversions may perhaps be of frequent occurrence in the species It is a well known fact that the leaves of many fossil plants from the Cretaceous have entire borders while the modern representatives of the same genera are often serrate denticulate or lobed Turning now to the seedling of the ordinary watermelon (Fig 1*a*) we find that the leaves develop in succession from the entire to the mature lobed form The cotyledons are oval and entire while the first leaf is almost an exact counterpart of the variety under consideration In the second leaf the lobed condition is beginning to appear while the third leaf would have the normal form of the mature plant On this account I regard this as a case of atavism rather than an ordinary mutation or it is probable that the watermelon embryo in passing from entire to lobed leaves is repeating some of the past stages in the history of its race Striking variations mutations and reversions should be carefully studied and recorded since it is by them alone that many of the problems of evolution can be solved

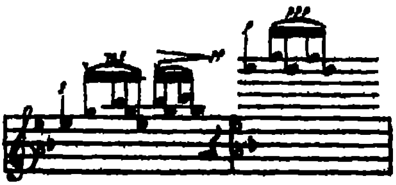
A HERMIT THRUSH SONG

THEODORE CLARKE SMITH

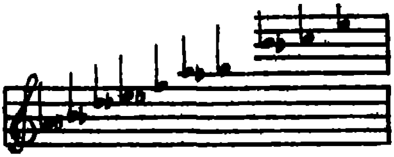
During the summer of 1902 I stayed from the twenty fourth of June to the thirtieth of July at a camp on the shore of Lake Memphremagog My tent was placed at the edge of a cedar and hemlock grove mixed with occasional maples and birches which furnished nesting places for a great variety of birds The most conspicuous singer was a hermit thrush whose nest was not far from the tent and whose song was heard every morning and evening and frequently during the day for over a month Others of his kind were also audible sometimes close at hand but none became so thoroughly familiar as this camp thrush I have heard him at extremely close range on one occasion from less than ten feet and have also been able to distinguish his song over the lake from a distance of fully three quarters of a mile From an abundance of material the following notes are contributed in the effort to analyze his vocal performance

In form the song of this thrush was very distinct clear cut and regular His typical phrase was as here shown This same form was repeated by the bird in higher keys usually somewhat simplified by the omission of one or more of the latter notes until at the top of the bird s register it become reduced to little more than the following The closer one approached the thrush the greater appeared the regularity as long that is, as the bird was in full song for when beginning or when singing softly he departed noticeably from his ordinary practice





On several occasions the bird sang near the camp cabin in which there was a piano and it was a simple matter owing to the regularity of the song to deter mine the pitch with considerable accuracy. With regard to the long opening notes I speak with great confidence for I took down a long series on two occasions and found the pitch unchanged. From these observations I determined that the thrush used phrases in the following keys. I heard no others and never detected any flatting or sharping. It will be noticed that these keys form part of the scale of A flat major. In this, and in fact in the whole song, the approximation to the human scale was striking.



The hermit's song consisted, nine times out of ten, in a regular alternation of low with high phrases. Two in succession on or near the same level he never in my hearing gave, but he would sometimes ascend or descend through a series of three different keys. There was no fixed order nor any necessary key relation between successive phases. I have long lists of such and am certain that the bird uttered his theme in whatever key suited his fancy so long as it was not a repetition of the theme just uttered. For example, one series began with a low B flat followed by a high A flat, then a middle F, then an upper B flat, then dropped to low A flat, soared up two octaves to high A flat, dropped to middle B flat, then down to low E flat This continual alteration of key was the most striking thing about the hermit's song, apart from its regularity and accuracy of pitch. It suggested somehow the orchestral handling of a theme by a musical composer, and made it beyond comparison more interesting as a performance than the simple repetitions of the olive backed thrush, or the endless variety of the thrasher.

The utterance of the theme was for all the lower forms distinct and without *portamento*. Now and then, although rarely, the bird gave his triplet or quadruplet notes a vibratory "trill," and in the very highest phrases the distinctness of vocalization was much diminished. The bird's voice never broke on its highest notes but his enunciation became somewhat indistinct, although never to such an extent as to disguise the form of his theme.

The voice of the hermit thrush was made individual by overtones giving it a considerable richness and penetration and even a metalic burr or buzz. It suggested somewhat the reed-quality of the oboe superadded to a flute's open tone. Direct comparison was possible only with the piano, a bugle and a flute, and needless to say, it was far closer to the last named, but very much more vibrant, less hollow. The "burr" was audible at short ranges only. At a hundred yards or less it blended to give the voice a singularly ringing metalic quality which gave it a carrying power unapproached by any other bird of that region. It should be said that in proportion as the bird seemed to be exerting himself, as for example on one occasion when suddenly joined by his mate, the metallic overtones were less prominent, and in certain of the key varieties they were nearly absent. The long opening notes were the freest, the high, rapid ones the most burdened with overtones. At their worst the highest figures were occasionally almost squeaky but in the full song they were by no means lacking in sweetness, and they were always clear and sharp.

Heard from a very close range the long full notes were fairly piercing, so sweet, full, and vibrant were they. They were too loud for comfort, and when the bird suddenly began to sing while perched on a fence about ten feet from my tent it fairly made my ears ring.

The most characteristic feature of the song in the line of vocal modulation was as simple as the phrase itself, but equally effective. The opening long note was struck firmly and held sometimes with a slight crescendo, but the succeeding rapid figures were progressively diminished in loudness until the last clearly uttered notes faded away in a silvery tinkle. This *smorzando* or *diminuendo* utterance was almost habitual with the "camp thrush," and was indescribably effective. It suggested the modulation of the piano player since it surpassed in extent of diminution and in delicacy of utterance at the end anything within the compass of a wind instrument. But the piano *smorzando* would lack the crescendo on the opening note.

The whole song was vigorous and sure in delivery, slow—since the phrases, taking at the most two and a half seconds in delivery, were separated by four to six seconds of silence—but perfectly steady in tempo, and certain in execution. The unusual richness and vibrant power of the tone, enhanced by the effective *smorzando* utterances of successive phrases, with the never-failing alternation of key and pitch marked the song off from any other sound of the Canadian woods

This bird was by no means unusual, nor on the contrary identical with others of his species. His nearest neighbor differed from him in several marked ways, being less regular in song form, having much more variety in his phrases, using minor as well as major keys, being less distinct and finished in utterance although rather sweeter in voice, singing a little more slowly and a little less loudly, being rather inferior in penetration, and not using the *smorzando* delivery so much. But both were mastersingers.

EARLIEST OBSERVED BIRD MIGRATIONS FOR COLUMBUS.

WALTER J. DERBY.

In compiling and arranging the list of earliest spring migrations given in this paper, the writer has simply edited the work of the older observers of the club with the hope that the list will be of interest to other workers in Ornithology and perhaps furnish a basis for more extended study along the same line.

The observations were all made during the years 1897 to 1902, and were all by members of the Wheaton Ornithological Club of the State University. A comparison of the data of spring migrations made by Mr. Frank M Chapman at Englewood, New Jersey, which is about sixty miles farther north than Columbus, with this list shows that the arrival of northward-bound species here is from a week to ten days earlier on the average, though some of the dates coincide very closely and some of the records are from two to three weeks earlier This difference is especially marked in the case of the Warbler migration which here reaches its height in the last week or ten days in April and the first week of May, while there the greatest flight occurs in the second and third weeks of May. The situation of Columbus is quite favorable, for lying on a north and south river it is in the track of the northward moving migrants, and is favorably located for early records. An effort was made to see whether or not the data in this table would bear out the conclusions reached by Dr. C. C. Trowbridge in his article in the September number of the *American Naturalist* on "Bird Migrations." He was led by the results of a series of long and careful observations to the conclusion that wind and not temperature was the cause of bird flights. Since, however, the data in the possession of the writer do not take systematic account of the volume of migration, the only recourse is to periods giving especially early records or an abundance of them. Another handicap to any attempts to differentiate the effects of wind direction and temperature lies in the fact that in this locality high temperature is usually coincident with southerly and south-westerly winds, and low temperature with north-west and north winds. By the courteous assistance of the local United States Weather Bureau, statistics were obtained for wind direction and mean daily temperature covering the months of April and May, from 1898 until 1902 inclusive. An examination of the list of records shows a noticeable scarcity of records in the first two weeks of April, although both the preceding and following weeks show several records. Comparison with the meteorological table shows during each year, without exception prevailing northerly winds and low temperature. This however being merely negative and possibly due to other causes can hardly be cited as strong proof. Attempts to correlate the wave of migration, extending through the latter part of April with the wind direction, can not be called successful except in one instance, that of 1902. In this year the records show a period of cold weather (Temp. 30 to 45 deg.) and prevailing northerly winds extending from the beginning of the second week in April to the middle of the third, with scarcely any records of migration During the time from the 18th to the 22d of the month however, the wind direction shifted to the south and south-west, and the temperature rose to 60 deg. The records of the Ornithological Club for that period contain many records of migrating species, most of them for the 22d and 23d, with the statement that they are about a week early This is the only good instance of positive evidence in the records, it seeming impossible to establish any clear connection in other instances. In the appended list the date is given, being the earliest record of its appearance by members of the Club and the name of the observer is placed after the species. Species not followed by names have been recorded by several members for the same time. The records for the Robin, Bluebird and Meadow-lark are not given, as some of these species winter here and of course it is impossible to distinguish the arrivals from the South from those wintering here.

Feb. 13.	Clangula hyemalis (Linn.) Old Squaw Parker.
Feb. 17.	Branta canadensis, Canada Goose Henderson.
Feb 19	Quiscalus quiscala aeneus, Bronzed Grackle. Kellicott.
Mch. 2	Aegialitis vocifera, Killdeer Smith.
	Zenaidura macroura, Mourning Dove Smith.
Mch 3.	Agelaius phoeniceus, Red-winged Blackbird Tyler.
Mch 6	Spizella socialis, Chipping Sparrow. Smith and Cole
Mch. 8.	Gallinago delicata, Wilson's Snipe Morse.
Mch. 9	Anas boschas, Mallard. Tyler
Mch 12	Passerella iliaca, Fox Sparrow Smith and Cole.
Mch 13	Zonotrichia albicollis, White-throated Sparrow Smith and Cole.
Mch 14	Pipilo erythrophthalmus Towhee. Morse
Mch 16.	Cathartes aura, Turkey Buzzard Griggs
	Spizella pusilla, Field Sparrow Smith and Cole
Mch. 17.	Turdus fuscescens, Wilson's Thrush. Parker
Mch 18	Sayornis phoebe, Phoebe Griggs
Mch 19.	Contopus virens, Wood Pewee Parker.
Mch. 23	Vireo flavifrons, Yellow-throated Vireo. Hine.
	Progne subis, Purple Martin Morse.
	Poocaetes gramineus, Vesper Sparrow. Smith and Cole
Mch. 24.	Tyrannus tyrannus, King Bird. Smith and Cole.
	Spiza americana, Dickcissel. Smith and Cole.
Mch. 25.	Chondestes grammacus, Lark Sparrow Hine.
Mch. 28.	Dendroica virens, Black-throated Green Warbler Henderson.
Mch. 29.	Empidonax minimus, Least Fly-catcher. Smith and Cole.
Mch. 30.	Scolecophagus carolinus, Rusty Blackbird. Smith and Cole.
Mch 31.	Larus argentatus, Herring Gull. Morse.
April 3.	Anas americana, Baldpate. Taylor.
April 5.	Chaetura pelagica, Chimney Swift Parker.

April 10.	Turdus aonalaschkae pallasii, Hermit Thrush, Williamson
April 15.	Turdus mustelinus, Wood Thrush. Mills.
	Chelidon erythrogaster, Barn Swallow. Jennings.
	Actitis macularia, Spotted Sandpiper. Hine.
April 17.	Harporhynchus rufus, Brown Thrasher. Morse.
April 18.	Helmitherus vermivorus, Worm-eating Warbler. Hine.
	Mniotilta varia, Black and White Warbler. Hine.
	Helminthophila pinus, Blue-winged Warbler. Hine.
	Dendroica aestiva, Yellow Warbler. Hine.
	Polioptila caerulea, Blue-gray Gnatcatcher Hine.
April 19	Piranga erythromelas, Scarlet Tanager Parker.
April 20	Galeoscoptes carolinensis, Catbird.
	Ammodramus savannarum passerinus, Grasshopper Sparrow. Hine
April 22.	Helminthophila chrysoptera, Golden-winged Warbler
	Dendroica virens, Black-throated Green Warbler. Williamson.
	Dendroica blackburniae, Blackburnian Warbler
	Dendroica maculosa, Magnolia Warbler.
April 23	Clivicola riparia, Barn Swallow
	Seiurus noveboracensis, Water Thrush Parker
	Ardea virescens, Little Green Heron,
	Icterus galbula, Baltimore Oriole. Parker
April 24.	Dolichonyx oryzivorus, Bobolink
	Habia ludoviciana, Rose-breasted Grosbeak Williamson.
	Passerina cyanea, Indigo Bunting
	Vireo olivaceus, Red-eyed Vireo Parker.
April 25.	Helminthophila celata, Orange-crowned Warbler Hine
	Setophaga ruticilla, Redstart Parker
	Geothlypis trichas, Maryland Yellow-throat
April 26	Icterus spurius, Orchard Oriole.
	Helminthophila peregrina, Tennessee Warbler. Hine
	Icteria virens, Yellow-breasted Chat.
April 27.	Petrochelidon lunifrons, Eave Swallow Griggs
April 28	Stelgidopteryx serripennis, Rough-winged Swallow. Taylor
	Turdus ustulatus swainsonii, Olive-backed Thrush Hine
	Vireo gilvus, Warbling vireo Taylor
April 29	Zonotrichia leucophrys, White-crowned Sparrow Hine
	Dendroica caerulescens, Black-throated Blue Warbler Hine and Henderson
May 1	Antrostomus vociferus, Whip-poor-will.
	Dendroica coronata, Myrtle Warbler
	Seiurus aurocapillus, Oven-bird Williamson
	Sylvania mitrata, Hooded Warbler. Parker.
	Geothlypis formosa, Kentucky Warbler Parker
May 2	Dendroica palmarum, Palm Warbler Hine.
	Melospiza lincolni, Lincoln's Finch. Osborn
May 5.	Myiarchus crinitus, Great-crested Flycatcher Teter
May 7.	Coccyzus erythrophthalmus, Black-billed Cuckoo.
	Dendroica pennsylvanica, Chestnut-sided Warbler. Hine.
May 8	Vireo solitarius, Blue-headed Vireo. Parker
	Trochilus colubris, Humming Bird. Osborn.
May 12	Compsothlypis americanus, Parula Warbler. Parker
May 13	[illegible]tonotaria citrea, Prothonotary Warbler. Hine.
	Coccyzus americanus, Yellow-billed Cuckoo. Mills
May 16	Dendroica castanea, Bay-breasted Warbler. Parker.

ENTOMOLOGICAL NOTES.

Some very practical results in the line of Mosquito warfare are presented in the "Reports on Plans for the Extermination of Mosquitoes on the North Shore of Long Island," published by the North Shore Improvement Association,* and accompanied by detailed map on large scale.

Work during the summer of 1901 is reported in detail in a carefully prepared volume, while a supplementary report is given in pamphlet form issued in the latter part of 1902. Prof. C. B. Davenport and Mr Frank Lutz, who have been responsible for the most of the entomological work, have collected a large amount of interesting and very valuable matter relating to the habits, distribution, breeding places, migration, etc., of the mosquitoes of that region. These observations show, perhaps, as the most important result, that the greater part of the mosquitoes infesting any locality are reared in the immediate vicinity of the houses where they become troublesome, that it is the smaller and quiet pools and the minute bodies of water that may occur in old tin cans, broken bottles, stumps, etc., rather than the larger bodies, that give them the condition to develop, and that while possible for some to be brought by winds from other parts of the island, this source of supply is of very little importance from the standpoint of health or even of annoyance. As stated by Mr. Lutz in his last paragraph, "Finally let us bear in mind that as a rule *every man is breeding his own mosquitoes, and every man should take care of his own property*. But, with it all, in a thickly populated district, many careful people can be made to suffer by the carelssness of one Here the community, as a whole, should take a hand, and through the officers compel the proper precautions on the part of those who will not otherwise take them."

Prof S. J Hunter has recently issued a work on "Elementary Studies in Insect Life" from the Publishing House of Crane and Co, of Topeka, which is intended for beginning students in Entomology. It is arranged in very attractive form and should prove very stimulating to all young people who may have the opportunity to work with it. The plan is to present in detail the life-histories of two common species, species that may easily be obtained and development followed by almost any boy or girl, these followed by chapters on the habits, senses, instincts and relations of insects. There is a short summary of the insect groups and instruction in the simple methods of laboratory work. While the work is profusely illustrated and many of the figures of superior character, there are some which are decidedly inferior, those of the cabbage butterfly and the canker worm moth for example, while entomologists will be likely to puzzle over the photograph from life of a "Woodboring beetle at work in yellow pine board." H. O.

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* Distributed by Mr. Wilmot T Cox, Sec'y North Shore Improvement Assoc, No. 49 Wall St., N Y

MEETING OF THE BIOLOGICAL CLUB.

Orton Hall, January 12, 1903.

The club was called to order by the president, Mr. Morse. The paper of the evening was given by Dr. Kellerman, who spoke upon his last summer's trip to West Virginia. He pointed out our interest in all the floras near our own. But that of West Virginia is especially interesting because so closely allied to that of Southeastern Ohio The flora of the State has been in the main neglected. Dr. Millspaugh and Mr. Nuttall have done practically all the work that has been published, but their lists include only 1366 embryophytes. The portion of the State along the Ohio River has a flora very much the same as that of the river counties in this State; but higher up along the Gauley River the flora is different and very interesting. He exhibited specimens of a number of the most interesting plants. He then spoke of his work on the Greenbrier River and the differences of the flora there from that of the Gauley. He spoke of the desolating effect of the destructive lumbering in the region, especially that now being perpetrated on the Cheat Mountain.

Under personal observation Mr. Swezey reported strawberries blossoming during Christmas week in Illinois, and that a few berries ripened as late as Thanksgiving day.

Mr. Jennings reported *Epilobium adenocaulum* from West Virginia, which is considerably out of its range. He reported *Paspalum pubescens* from Sandusky.

Mr J. G. Sanders spoke of an abnormal Podosphaera described by him in the current number of the Journal of Mycology.

Dr. Kellerman spoke of an abnormal beet six feet tall which flowered the first year. He showed pictures of an abnormal buckeye with very peculiar almost pinnate leaves. He spoke of three new species named for himself by a German botanist, to be described in the Journal of Mycology. He reported a large number of successful experiments in tracing the connection of different forms of rusts with each other. He spoke of the three forms of prickly lettuce in Ohio, and of the disagreement of the eastern botanists in regard to them.

Miss Sater, Miss Brace, Mr. Whetstone, Mr. E. A. Sanders, Mr. Whetsel, Mr. Arundel, Miss Stewart, Miss Hite, Mr. Dyer and Miss Mark were elected to membership.

R. F. Griggs, *Sec'y.*

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MUSCULAR AND SKELETAL ELEMENTS IN SPELERPES LONGICAUDUS.*

Henry Spencer Houghton.

The development of one of our commonest species of Salamander affords an opportunity for the study of many interesting problems. The author was influenced, however, in taking up a study of the skeletal and muscular elements in Spelerpes longicaudus, by several considerations In the first place, there is a surprising lack of literature, especially on the latter subject. The question of the origination and development of adult muscles and of the number and function of transitory larval muscles, and of the relation of the two, seems to have been entirely neglected. The skeletal elements have been thoroughly worked for the adult form, but there are some modifications in the larval skull that have not been touched upon. Secondly, this form is abundant, of wide distribution, and readily obtainable, and this fact together with the facility with which it may be prepared, renders it valuable material for laboratory purposes The work was done in the Embryological Laboratory of the Ohio State University, under the direction of Professor F. L. Landacre, and was offered as a thesis for the Baccalaureate degree.

This paper will attempt to cover merely a discussion of the skeletal and muscular elements of a 12 mm. larva, and will be for the most part descriptive, a few comparisons only being drawn with Rana and Cryptobranchus.

Spelerpes longicaudus is one of the commonest and most widely distributed species of the Plethodontidae. Its general appearance and markings are similar to Sp. bilineatus, and they are commonly found associated together in nature. Their habits, larval development and the noticeably longer tail of Spelerpes longicaudus form, however, distinguishing marks. The larval development of Sp. bilineatus is much more rapid than that of its relative; a 9 mm. specimen which I observed had both fore and hind limbs fully formed, while a 12 mm. Sp. longicaudus has merely limb buds, scarcely distinguishable to the naked eye Of its habitat, Cope says "This beautiful animal is not very active in its habits and is almost always found in rocky ground and in fissures and caves in cliffs." (Batrachia of N. A., p. 154.) This species is scarcely ever found in water save in the breeding season, while Spelerpes bilineatus abounds in rocky brooks. The larvae may be found in open water, but at an early age they show an instinct for concealment, and are more readily found under leaves and pebbles lying in the pool

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* Contribution from the Department of Zoology and Entomology, IX.

EGGS.—The eggs of Spelerpes may be found most abundantly in May and June. "They are deposited in a single layer upon the lower side of submerged stones, each batch containing from thirty to fifty eggs The stones which are suitable for this purpose must be in the form of an arch allowing the water to flow beneath. They are generally in the more rapidly flowing portions of the brook, but the depth of the water must be such that the eggs are at all times entirely submerged, as otherwise the dash of the ripples striking against them would subject them to mechanical injury" (H. H. Wilder, "American Naturalist" Vol. XXXIII, p. 231.) The eggs are attached to the under surface of the rock by means of a gelatinous envelope in which they are encased, the same envelope keeps the eggs separated from each other much as in the case of frog's eggs

LARVA.—The larvae of Spelerpes longicaudus are hatched somewhat early and continue for some time in the larval form. The larva at 12 mm has the gills well developed, partially covered by an opercular fold The tail is long and tapering, with a broad, delicate and rounded fin. The pigment is well distributed over the upper surface of the tadpole, but is lacking on the under surface, except for a few cells on the fin The pigmentation is continuous over the anterior part of the head, but under a lens shows a double row of unpigmented areas along the dorsum, beginning behind the eye and running close to the fin There is very little change in pigmentation at metamorphosis, as the following description of the pigmentation of the adult will show. " * * * generally * * * more thickly crowded along the sides, sometimes forming a distinct spotted band along the sides of the tail; these black bands are generally aggregated into a series of vertical bands. In younger specimens * * * the spots above are arranged in three irregular lines, one median, and two lateral larger ones. The muzzle and entire under parts are immaculate." (Cope, Batrachia of N. A., p. 154.) The pigment spots appear as brown or grayish blotches of irregular contour. The anterior and posterior limbs may be noticed as small buds, just posterior to the gills and anterior to the anus, respectively.

TECHNIQUE.--The specimens were killed and hardened for four weeks in 4 per cent. Formalin. After taking the two grades of paraffin, they were cut (.03") and lightly stained in a Delafields' Haematoxylin, after which they were washed and ripened in water for 48 hours This process gives a thoroughly discriminative and brilliant stain, which is admirably adapted for all classes of such material for general purposes Three series were made, one being the stage studied, and the other two serving as checks on the first. The reconstructions of the skull were plotted in the following manner. a micrometer eyepiece was calibrated, arbitrarily, to co-ordinate paper, then the lens of the eye of the specimen, which is practically spherical, was measured vertically and the distance marked on the co-ordinate sheet. The number of sections in which the lens appears was next carefully noted, and thus the ratio of longitudinal to vertical measurements on the co ordinate paper was obtained This ratio was found to be 15 horizontal to 22 vertical. By calling the ratio 5.7, therefore, and adding one section to every 21 read, accurate results were obtained, and a perfectly proportioned plot drawn. Plates 8, 9, 10 were outlined with a camera and filled in by freehand.

OSTEOLOGY.—The skull of the 12 mm tadpole of Spelerpes longicaudus differs radically from the adult skull, and shows close resemblance to the adult skulls of some lower forms. Wiedersheim lays down the general characteristic visceral skeleton of Urodeles as follows. "We may consider the ground form, as present in the larva, to consist of five pairs of bars. The anterior pair, or hyoid, consists of two pieces, as do also the first two branchial arches. The third and fourth branchial arches are much smaller and are connected with their fellows of the opposite side by a single or double basal piece. At the close of larval life, when the lungs come into use, the two hinder pair of arches disappear entirely * * * In the genus Spelerpes, which possesses a sling-like tongue, the lateral (dorsal) segment of the first true gill-arch grows out into a long cartilaginous filament which extends far back under the skin of the back" (Comparative Anat of Vertebr., p 74.)

In general, the hypobranchial apparatus of the 12 mm larva corresponds very closely to the above description, but there are some minor points of difference The hyoid is a single bar, the cerato-hyal, and shows no trace of a hypohyal, and the third and fourth branchial arches are not much smaller than the other two. The singular spatula-shaped urohyal is completely lost at the close of larval life. (See Plate 9)

In Spelerpes, the protective capsule of the eye is not formed from the quadrate as in Rana, but by a slight process from the trabecular cartilages, and while in Rana (at 12 mm.), the auditory apparatus is merely a process arising from the trabeculae, in Spelerpes there is a fully formed capsule It is possible that the diverse habits of the two forms may account for this reversion of development. Spelerpes, which spends its larval existence for the most part hidden under rocks and in the dark, needs an acuteness of hearing and a sensitiveness to vibration for which its cousin compensates by an early developed and well protected eye.

TRABECULAE.—(Plate 10.) The trabeculae cranii appear as two longitudinal bars supporting the anterior end of the brain and the nasal sacs. Just behind the superior labial cartilages, they are flattened out into a pair of disk-like, slightly concave projections serving to support and protect the nasal sacs. There is no juncture of the trabecular bars here as is the case in the frog. Just behind the nasal capsule, the trabeculae resume their rod-like form, presently becoming compressed to form a sort of triangle, concave on the outside. This is the optic capsule before mentioned. Back of this point, the trabeculae are pierced by the optic foramena (Plate 8), and again, still further back, by another and larger foramen, which admits some of the larger vessels to the brain. Just above this latter foramen, the quadrate separates from the trabecula This is given off from the upper half of the trabecular bar (Plate 8) and curves down to meet and articulate with the lower jaw (Meckel's cartilage), while the lower half curves in to meet its fellow just in front of the notochord (Plate 10, bp.), forming a support for the main part of the brain. The auditory capsule is continuous with the quadrate above and trabeculae below From the point of their juncture, the trabecular bars continue as a pair of flattened rods—the parachordals (Plate 10), which together with the notochord form the floor of the brain case Just behind the auditory capsule, the parachordals show a leaf-like process, which serves as a protective case for the medulla and upper cord.

UPPER LABIALS.—Plates 8, 9, 10, la) These labials are a pair of rounded caps which fit over the ends of the trabeculae. They are pointed above and blunt below. It seems that these labials should be used, governed by suitable muscles, in sucking, in case the larva uses that means of obtaining food, but a diligent search failed to reveal any muscles which might be used in that way. The superior labials are, like the trabecular cartilages, entirely separate from one another. They are so freely and loosely articulated, moreover, as to permit of the possibility of considerable movement

LOWER LABIALS.—(Plates 8, 9, lb.) The inferior labials, on the other hand, are so fused as to present the aspect of a single, compact cap, which fits over the rounded anterior part of the lower jaw. They are comparable in a general way, to the labials of Rana. The upper and lower labials are apparently among the first cartilages to appear, since at this stage they are very compact and dense cartilaginous tissue, from which all trace of cartilage cells has disappeared.

MECKEL'S CARTILAGE.—(Plates 8, 9, mc.) Meckel's Cartilage forms the basis and largest part of the lower jaw. It articulates in front with the bar of the lower labial, and fuses there, more or less completely, with its fellow of the opposite side. Behind, it articulates strongly with the quadrate (Plate 8, qd.). The cartilages are slender and rounded anteriorly, but become much heavier and more ovoid as they near their articulation with the quadrate. The coronary process is plainly marked, just in front of the posterior articulation, and directly under the optic foramen. The massive temporal and masseter muscles, which have their attachments on this process, together with the heavy pillar of the quadrate, form a bulging prominence which is readily discernible with the unaided eye.

THE QUADRATE.—(Plate 8, qd.). The quadrate is fused completely above with the trabecula, at a point dorsal to the second foramen, as before stated. Above and behind it fuses with the auditory capsule, while below it sends a heavy vertical bar to articulate with Meckel's cartilage. The quadrate is the heaviest solid cartilage in the skull at this period, and helps to form the rim of a deep protective socket within which the eyeball rests. The fusion of the quadrate with the capsule of the ear is only slight at this stage, but the mesoderm between the two parts is seen to be rapidly chondrifying, and indicates an extensive fusion later.

AUDITORY CAPSULE.—The auditory capsule, although not completely chondrified, can be traced very readily. The two capsules form the side wall of the skull, and indications of their juncture over the top of the brain can be detected. They are fused with the quadrates in front and with the trabeculae cranii below, but their posterior extremity is a free rounded surface. At the 12 mm. stage, therefore, the brain lies exposed above, but is protected laterally by the heavy auditory capsules and ventrally by the broad trabecular plate, and by the parachordals. The semicircular canals in the ear are fully formed, and there is full nervous connection with the brain. The circular (fibrous) patch so prominent in the frog at a similar stage can be detected, but with difficulty. It is the foreshadowing of the future stapes.

TEETH.—Teeth appear on the upper and lower labials and on both the trabeculae cranii and Meckel's cartilage. They are well along in development, and can be seen pushing their way through the skin of the mouth. They are beginning to appear on the branchial arches and ceratohyals as well.

BRANCHIAL APPARATUS.—(Plate 9.) The branchial apparatus of Spelerpes shows a marked difference from that of both Crytobranchus and Rana. The most noticeable features of the branchial cartilages of Spelerpes longicaudus are (*a*) the absence of a basi-branchial plate, (*b*) the large size and peculiar contour of the urohyal, (*c*) the ceratohyals, which hang free from the basihyal, and do not articulate with the quadrate as they do in Rana and Cryptobranchus, and (*d*) the absence of any "free" branchials, that is, any branchials unattached to the basihyal cartilage.

BASIHYAL.—(Plates 8, 9, bh.) The basihyal is a rounded and slender rod of cartilage projecting well forward into the tongue and prolonged posteriorly into the slender urohyal Just behind the rounded anterior extremity is found the articulation of the ceratohyals. This articulation is not close, but the ceratohyals seem to be rather loosely swung from the front of the basal cartilages. From the posterior portion of the cartilage, the first and second cerato-branchials are given off in close succession, and from this point the cartilage continues as the urohyal In the specimen prepared, the basihyal and branchial cartilages were probably somewhat distorted, on account of the unnatural position of the tongue, so that in the drawing (Plate 8) they are higher in relation to the rest of the skull than they should be; the measurements, however, and relative sizes are accurate.

UROHYAL —(Plate 9, uh.) The urohyal bar is much longer in Spelerpes longicaudus than in the same stage of the frog. It is median and basal, and forms simply an elongation of the basihyal. The urohyal terminates, however, in a flattened spatula, which affords a place of insertion for two heavy muscles.

CERATOHYALS —(Plates 8, 9, ch.) The ceratohyals are a pair of curving bars of cartilage, swinging freely from a loose articulation with the anterior part of the basihyal Their direction is dorso-caudal, and they terminate freely in the mesoderm a short distance behind the quadrate and external to the auditory capsule.

BRANCHIAL ARCHES. – (Plate 9) The branchial cartilages at the given stage of this specimen are all *in junction*; *that is*, *none* of them hang free at either extremity. They may be classified into three pairs of ceratobranchials and four pairs of epibranchials.

The first ceratobranchial is the largest of all the branchial bars (Plate 9, bra.). It is given off from the anterior extremity of the basihyal. It curves slightly down and out and shortly gives rise to the first epibranchial and joins with the second ceratobranchial in originating the second epibranchial arch. The second ceratobranchials (Plate 9, brb.) are at their beginning noticeably smaller than the first ceratobranchials, but soon increase in size. This ceratobranchial gives rise to the second epibranchials (in conjunction with the first ceratobranchial bar) and to the third ceratobranchial (Plate 9, brc.) The third ceratobranchial soon divides into the third and fourth epibranchial cartilages (Plate 9, bc., bd.). The four epibranchials run free for some distance and at their posterior extremity are again united to one-another by a curving bar of cartilage.

MUSCULATURE.—A careful comparison of the muscles of this stage of Spelerpes longicaudus with the musculature of Rana and Cryptobranchus seems to show a close resemblance to Cryptobranchus, especially in the muscles of the branchial apparatus. Of course, no homologues of these muscles appear in the adult Rana, but even the larger head muscles correspond much more closely with those of Cryptobranchus. There appears to be no special modification for sucking, or any special muscles for that purpose. All of the muscles described are those of the adult Salamander in various stages of development. In the nomenclature of the muscles of the branchial apparatus, the analogies of Cryptobranchus have been very closely followed out.

MUSCLES OF THE HEAD

M. TEMPORALIS.—(Plate II, Fig. I, mtm.) The temporalis is the most prominent of the muscles of the head. It arises on the quadrate cartilage, just posterior to the second foramen, and is inserted on the inner side of the coronary process. It is a broad, heavy sheet of fibres, broader at the insertion than at the origin. Its direction is ventral and slightly caudal. In reality, M. temporalis is made up of two parts, the one just described above, and a second, which I shall describe as—

M. PTERYGOIDEUS.—This is a thin strand of fibres arising on the quadrate bar, just below the origin of M. temporalis, and sending its fibres ventrally to unite with those of the temporalis. It corresponds very closely to the similar muscle in Cryptobranchus, which is described as follows: "This is a very insignificant muscle * * * and might almost be considered a fasciculus of M. temporalis. (Thesis, J. H. McGregor.) The muscle is entirely covered dorsally by M. temporalis, and acts with the temporalis in lifting the mandible, in opposition to the action of M. depressor maxillae inferioris.

M. MASSETER.—(Plate II, Fig. I, mm.) The masseter is a heavy, bulging muscle, partly covering M. temporalis. It arises on the anterior third of the auditory capsule, and, running downward and forward, is inserted on the outside of the mandibular bar (Meckel's cartilage), a short distance in front of the coronary process. The insertion of this muscle is comparatively very broad, though it is thick-bellied and rounded in the center.

M. DEPRESSOR MAXILLAE INFERIORIS.—(Plates II, Fig. I, mdm.). This is a large and powerful muscle, which, using the base of the lower mandible as a lever, depresses the jaws. It has two origins; the first in the middle of the optic capsule, just posterior to the origin of M. masseter, and a second, which is lower and posterior to the first. The fibres from the two origins, however, soon intermingle, and evidence of the double origination is lost. The muscle extends down and forward, parallel to

M. masseter, and is inserted on the rounded base of the lower mandible (Meckel's cartilage). Turning now to the ventral surface, we find the—

M. SUBMAXILLARIS.—(Plate 11, Fig. 2, msb.) This muscle is a broad, thin sheet of fibres covering in the space between the mandibles almost completely It extends between the two rami throughout their extent, save for a small space at their anterior extremity. The muscle is a very delicate one, and the fibres are loosely conjoined, seeming to indicate a tardy development as compared with the other muscles. The function of the submaxillaris is still a matter of doubt, but that it is closely connected with the respiratory function seems fairly certain.

M. SUBMENTALIS.—(Plate 11, Fig. 2, msm.). This small and insignificant muscle appears as a tendinous band at the extreme anterior portion of lower jaw. Its function is to approximate the rami of the jaw, but it appears to be of small practical consequence.

MUSCLES OF THE BRANCHIAL APPARATUS.

The branchial muscles of the 12 mm. Spelerpes longicaudus show a very marked similarity to those of the adult Cryptobranchus, although they are not quite so numerous, or so complex. The group consists of a paired sternohyoid, a hypobranchial, a constrictor, levator and depressor of the arches, a geniohyoid, a well defined cerato-branchialis and a small omohyoideus

M. STERNO-HYOIDEUS.—(Plate 11, Figs. 2, 3, msh.) This muscle is a direct continuation of the fibres of M. rectus abdominis. The recti abdomini, as they pass forward from the posterior part of the body, alter both in contour and in position. In the body proper, they are seen as two thin vertical sheets of muscle, bounding the body cavity. As they pass into the head region, however, they gradually assume a median position and become thickened to form a pair of round, heavy muscles, which fuse in the region of M. temporalis, and have their common insertion on the basihyal at the point of union of the first ceratobranchial. The muscle is superimposed on the urohyal cartilage.

M. GENIOHYOIDEUS.—(Plate 11, Figs. 2, 3, mgh.) This muscle arises on the lower mandible, just posterior to the insertion of M. submentalis. From this point it extends directly backward, as a small rope-like muscle, to its insertion on the spatular end plate of the urohyal cartilage. Its function is to draw the branchial apparatus forward.

M. HYPOBRANCHIALIS.—(Plate 11, Fig. 3, mhb.) This muscle arises on the ventral surface of the ceratohyal cartilage, inside of the origin of the following muscle. Its fibres run posteriorly and obliquely inward, and are inserted along the course of the posterior two-thirds of the first epibranchial, except at the posterior end of the branchial.

M. CERATOBRANCHIALIS.—(Plate 11, Fig. 3, mcb.) This muscle is a thin sheet of fibres arising on the ventral surface of the ceratohyal cartilage, just outside of the origin of M. hypobranchialis, and sending its fibres inward to the extremity of the operculum The function of the muscle is to raise the opercular fold and to create thus a suction through the gill slits There is, of course, no homologue of this muscle either in Rana or in Cryptobranchus

M LEVATOR ARCUUM BRANCHIALIUM.—(Plate 11, Fig. 1, mla) This slender and insignificant muscle arises as a fasciculus of M longissimus dorsi It is given off from that muscle at the extreme posterior end of the otic capsule and extends posteriorly and obliquely downward to an insertion on the first epibranchial bar It serves to raise the branchial apparatus

M. CONSTRICTOR ARCUUM BRANCHIALIUM —Plate 11, Fig 3, mca , mce , mci) This muscle is divided into three equal parts, which, from a common origin, separate and run to three distinct and different insertions The muscle itself is a continuation or prolongation of the fibres of M hypobranchialis, and takes its course along the inner or body side of the arches Its first fasciculus is inserted on the course of the second epibranchial cartilage, its second fasciculus on the the third epibranchia and its third part along the course of the last arch Its evident function is the closing of the branchial clefts, acting with M ceratobranchialis to create a suction of water through the clefts.

M DEPRESSOR ARCUUM BRANCHIALIUM —(Plate 11, Fig 2, mdb , Fig 3, mab) This muscle is a sheet of fibres arising on the inner side of the last branchia and sending its fibres inward to mingle in the middle line The main part of the muscle is just anterior to the tracheal opening, and some of its fibres even mingle with those of the following muscle The name of the muscle indicates its function.

M OMOHYOIDEUS —This is a rather small and insignificant muscle at this stage It arises in the region of the future scapula and sends its fibres downward to mingle around the trachea This muscle does not function before the metamorphosis, and as no sign of a scapula appears, it cannot now be traced to a definite origin.

BODY MUSCLES

The two body muscles which appear at the present stage are the M. longissimus dorsi, and M. rectus abdominis.

M. LONGISSIMUS DORSI —(Plate 11, Fig 1, mld , mli) This large and important muscle has a double origin The first is on the auditory capsule, on the dorsal side next to the surface, and in the region of the articulation of the jaw and of the eighth nerve. The second origin is considerably posterior to the first and is at the base of the brain, on the parachordal cartilages. From their origins, both fasciculi run directly tailwards, uniting in the region of the tenth nerve, to form a dumb-bell-shaped muscle which partially surrounds the medulla. After this point, the muscle rapidly increases in size, as it runs on back toward the tail.

M RECTUS ABDOMINIS —(Plate II Fig 1 mra) The sternohyoideus muscle already described is a continuation of M rectus abdominis As the muscle runs back it becomes more and more flattened until it presents the typical aspect of a thin sheet of tissue lining the ventral body wall In this specimen it presents no unusual characteristics

MUSCLES OF THE EYE

No well defined musculature for the eye was found but two recti muscles or traces of them could be distinguished They are very small and while their insertion on the eyeball can be seen plainly their origin is lost in the surrounding mesoderm

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EXPLANATION OF PLATES

KEY TO PLATE 8

A reconstruction of the skeletal elements of the head

SIDE VIEW

la	Upper labials	pc	Parachordal cartilages
tr	Trabecula	pf	Posterior foramen
lb	Lower labials	pn	Coronoid process
qd	Quadrate cartilage	au	Auditory capsule
mc	Meckel's cartilage	ba	First branchial arch
bh	Basihyal cartilage	bb	Second branchial arch
ch	Ceratohyal cartilage	bc	Third branchial arch
nb	Nasal capsule	bd	Fourth branchial arch
op	Optic foramen		

KEY TO PLATE 9

A reconstruction of the skeletal elements of the head

VIEW OF THE BRANCHIAL APPARATUS

bh	Basihyal cartilage	ba	First epibranchial cartilage
uh	Urohyal cartilage	bb	Second epibranchial cartilage
bra	First ceratobranchial cartilage	bc	Third epibranchial cartilage
brb	Second	bd	Fourth epibranchial cartilage
brc	Third	ch	Ceratohyal cartilage

KEY TO PLATE 10

A reconstruction of the skeletal elements of the head

VIEWED FROM ABOVE

tr	Trabeculae	pc	Parachordal cartilages
bp	Basal plate of the trabeculae	au	Auditory capsule
la	Upper labials	ch	Notochord
nb	Nasal process		

KEY TO PLATE 11

Reconstruction of muscles

Figure 1 Lateral view

Mtm	M temporalis	Mra	M rectus abdominis
Mla	M levator arcuum branchialium	Mcb	M cerato-branchialis
Mld	M longissimus dorsi	Mdm	M depressor maxillae inferioris
Mli	M longissimus dorsi inferior fasciculus	Mm	M masseter

Figure 2 Ventral view

Msm	M submentalis	Mdb	M depressor arcuum branchialium
Msb	M submaxillaris	Mgh	M genio-hyoideus
Mcb	M cerato brenchialis		
Msh	M sternohyoideus		

Figure 3

Reconstruction of branchial musculature

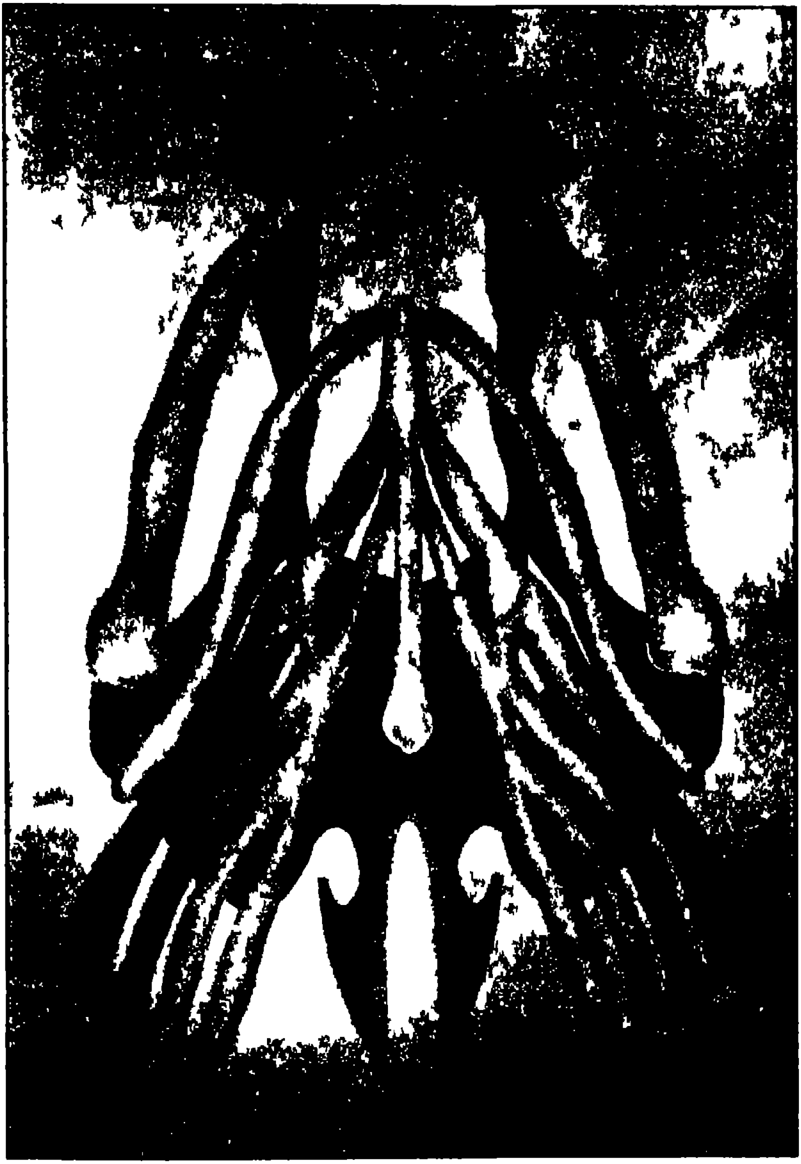
Msm	M submentalis	Msh	M sternohyoideus
Mgh	M geniohyoideus	Mca	M constrictor arcuum branchialium first fasciculus
Msb	M submaxillaris		
Mcb	M cerato branchialis	Mce	M constrictor arcuum branchialium 2nd fasciculus
Mhb	M hypobranchialis		
Mab	M depressor arcuum branchialium	Mci	M constrictor arcuum branchialium third fasciculus

In the reconstruction the ceratobranchial muscles are removed, the sternohyoideus muscles are cut out so as to show the M depressor arc branchialium and one of the geniohyoideus muscles has been cut to show the origin of M sternohyoideus The submaxillaris has been represented as slit, and the flaps turned back

OHIO NATURALIST *Plate* X.

HOUGHTON on "Spelerpes longicaudus."

P



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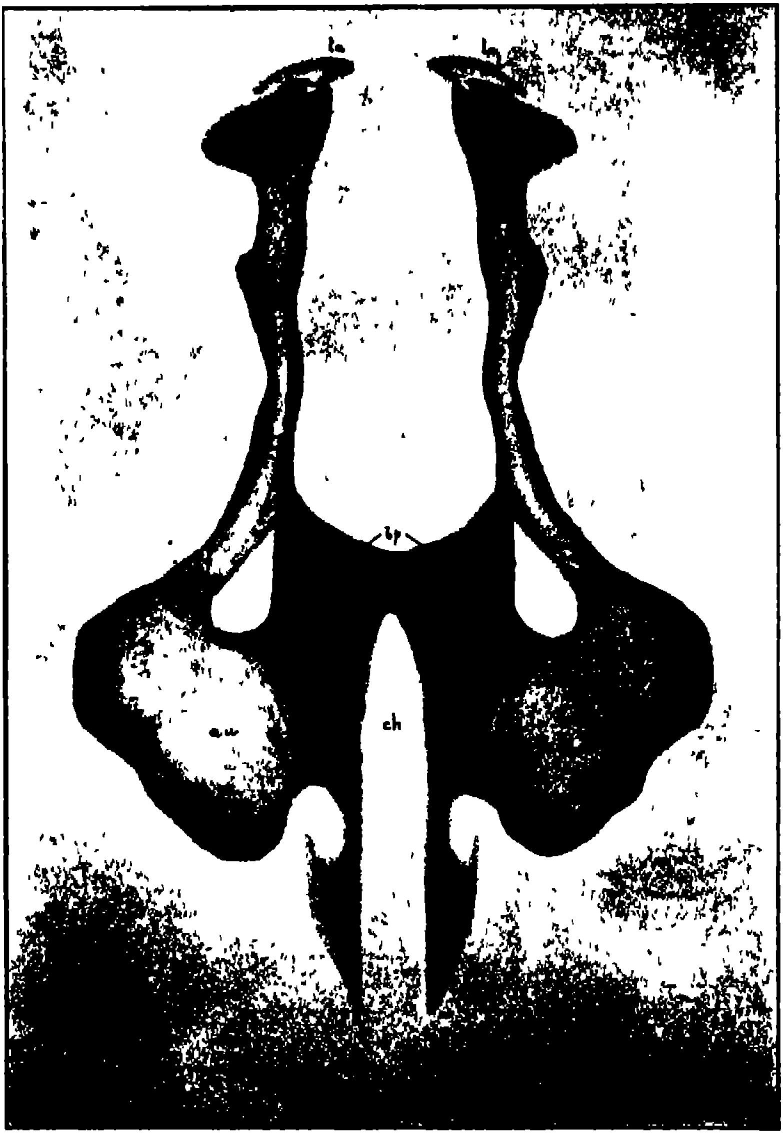

HOUGHTON on "Spelerpes longicaudus"

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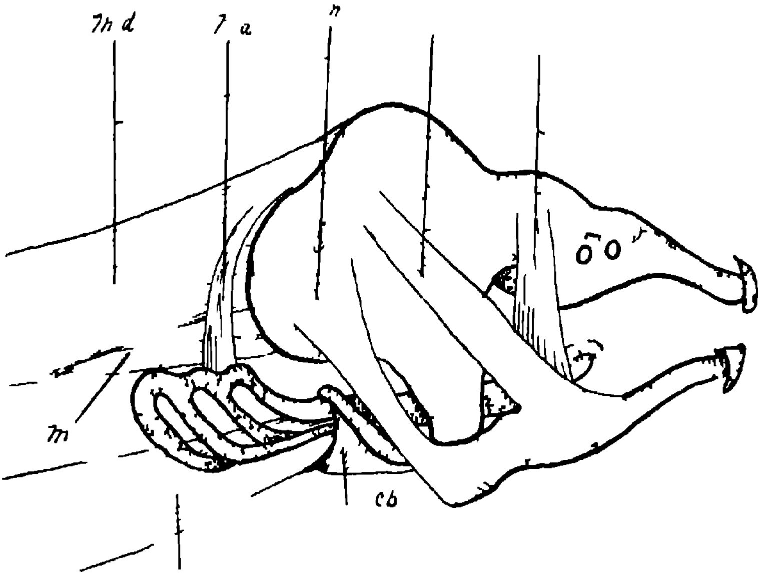

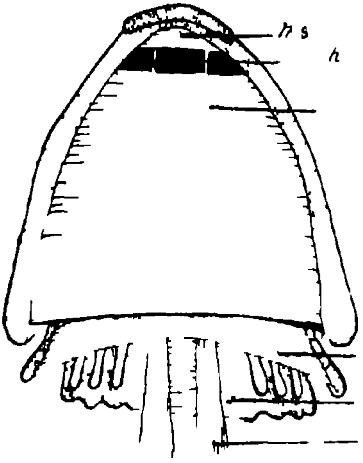

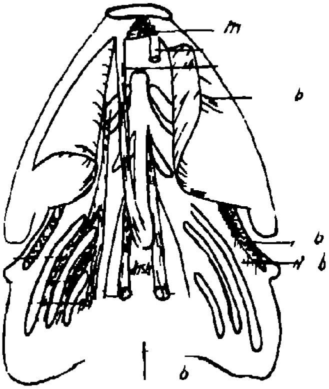

II N

ON THE AUTUMNAL SONGSEASON.[*]

J. R. TAYLOR

What I have to say is so patently unscientific that my first word must be a disclaimer of any such intention. Subjective method like mine is, I know, anathema in science. From an objective standpoint there is no music in the Brown Creeper's note, it is a creaking, a filing, an old chair is as musical, yet I have followed it as Ferdinand followed Ariel. It is courage come to share our winter, a conclusion not necessarily unscientific. Imagination, witness the discovery of Neptune or the setting up of the mastodon from fragments of bones, is as great a force in science as in the arts; and there is no great gulf fixed between science and art, the mind working not differently in the two fields. We of the opposite camp follow beauty, you truth, the Cardinal in the snow means as much by one method as by the other. Therefore if we learn gladly of the scientists, the reverse is true also, and because I have learned birds chiefly by their songs, I find I have to ornithologists, and however small it may be, interesting and supplementary information.

Even scientists know that there is a definite songseason, in a way synchronous with the breeding season, from March to June. It is also well known that birds sing beyond this period, the only absolute lulls seeming to fall in August and in December. I have heard the Bluebirds singing in the snow at Christmas, the Robin on New Year's Day, and the Carolina Wren, in the words of Mr. Riley, sings when he durn pleases. But the spring songseason remains fixed and unapproachable for its continuity and multitude of song. What has been more neglected is the autumnal songseason, which seems to me also a definite period, more or less immediately preceding the departure of the birds for the south. At the end of August, this summer, the Orioles and the Warbling Vireos, after many weeks of silence, were all singing again on the campus, and soon after, of course, were gone. This, I think, is a habit which may be found to be universal. I cannot be sure of certain birds. The Whippoorwills sing on into September apparently without a break. In the Adirondacks a few years ago the Barred and the Great Horned Owls were silent in July and August, and hallooed over the lakes all night long in September, but in their case this could hardly precede a migration. I have heard the Bobolinks sing for a few moments in the dawn, at the end of August, after they must have changed plumage, and after more than a month of silence; I have heard the Red-winged Blackbirds in October in a chorus unheard since early July; and the list might be made a long one, in each case preceded by a long interval of silence, and heard at a certain date year after year. Not to mention the singing migrants, varying widely from the Upland Plover to the Whitethroats, Solitary Vireos, Ruby-crowned Kinglets, the following will serve as examples. Both the Orioles sing in late August and early September, Field Sparrows in September, Vesper Sparrows into October, Fox Sparrows into November; the Warbling and the Red eyed Vireos in September, the Maryland Yellowthroat in September, and in the same month the Catbird and the Brown Thrasher, and more rarely I have heard the Woodthrush also, though he sang only the preludes without the flute-notes I have never heard the Flycatchers sing again after their summer silence, nor the Tanagers, nor the Martins, nor many of the Warblers and Thrushes

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[*] Read before the Wheaton Club of the Ohio State University, October 14, 1901.

In each case, the song seems an accompaniment or precursor of migration. The Junco's addition to his song, in April just before he departs for the north, is parallel I cannot presume to offer an explanation To me it seems several possible things, memory of the spring's journey bringing a repetition of the song, or rehearsal and education of the young birds, although it seems to me difficult to prove that only the young birds sing, or, as it has been called, "false dawn" of sex, a mating without the nesting, which I have seen the Mourning Doves do, or, perhaps fantastically, farewell to the land of the nests of northern summer If it is true that the Grouse will drum on the old courting log even in October, a recognizably sentimental operation, none of the suggestions is preposterous. Why birds sing is hardly to be explained by anatomy The general opinion of ornithologists seems to be that song is an expression of pleasure, and that birds do not sing in fear or sorrow I have known a particularly gorgeous sunset to waken the Woodthrushes in midsummer, and it seemed to me not unlikely that the pleasure of the rich color sensation might partly account for it It is probable that the autumnal songseason is a time of gayety and novelty, a recognition of old places, an anticipation of new, together with some associated memory of the choosing of the mates. The impression may be further explained by the character of the song in autumn.

It is always difficult to hear and know the autumnal song-season, both because it is so much less in volume and continuity than in spring, and because it is not like that of April full-throated. The quality is changed,—if I were before a less formidable audience, I should say sea-changed. For it is as if the birds were singing under water, underground. It is as if they sing without opening their beaks; which indeed they seem sometimes to do even in spring, for I have heard both the male and the female Thrasher sing so in the nesting, each with the twig or straw in mouth; and I have never heard the Hermit Thrush in spring migration sing in any other way. This last instance may illustrate my meaning I have verified the experience through several Aprils. The first hearing was in this manner For a long time I had been sitting still to watch the Hermit flitting and returning among the naked copses by the old river-bed, and what with his nearness and the fresh April song about me, the memory of his song came to me clear and clearer. Let not Science reproach me for this!—I was fancying what old law, what jealous traveler's silence on the way to the happier north his home, kept unuttered in the bird's white breast that high romance, the voice of our best dreamer, even the memory of which made sunset flash across the mountain lakes to me The memory, the fancy, grew so vividly upon me that I smiled to find myself placing actually somewhere, across the Olentangy, upstream, downstream, the phantom singing of my own creation Then I woke to the realization that it was an actual song, a Hermit Thrush really singing, but very far away And last of all, I saw the dappled throat of my Thrush, which was always here and there about the leafless thickets, near me in the sun, saw his throat ruffling, and knew that he was the singer of the song that seemed, across the river or across the years, so far away

I ask pardon for such unedifying rhapsody, but the quality thus suggested is characteristic of the autumnal songseason Some birds apparently change the form as well as the quality of their song, making of it an entirely new composition, the Bobwhite, for instance, and (I think) the Chickadee, and the Carolina Wren in September has often set me hunting down a new song, surprising me at length to find him, that piper of indomitable and far ringing cheerfulness, now singing a secret bubbling continuous Goldfinch like song But most of our birds, without changing the form of their song, change the tone-color as I have described. So the Catbird sings, so the Brown Thrush, at your shoulder, may be, but seeming a half mile away, so sing our most frequent autumnal vocalists, the Meadowlarks, Cardinals, Song-sparrows, Robins; half-song, a whisper-song, an echo, a ventriloquism It is, I suppose, simply that they sing with half-voice, as we might hum to ourselves a melody that haunts us through the day's work

But it is easier for me to deal with effects than with causes, and I shall not this time apologize, for these are my last words The autumnal song seems to me not less beautiful than that of April; not the same triumphant, but memorial, charged with emotion, an art wrecked by its own beautiful joy, autumn's fit utterance, when even Anosia, the red monarch of all the butterflies, migrates among the departing birds and the unreturning leaves; and when always across the sky, in October, in November, as long as the Witch-Hazel is in flower, the Bluebirds play their pipes of passage.

FOOD PLANTS OF SOME BYTHOSCOPIDAE.

E. D. BALL, Utah Ag. College, Logan, Utah

In giving food plant records it seems desirable to distinguish those records that are the result of repeated observation, or made under circumstances that admit of slight chance for error, from those that are based on accidental occurrence of one or more specimens upon some given plant. The adults of most all of our leaf-hoppers fly very readily and are often found on plants adjacent to the one they feed upon, especially after a sweep net has been vigorously used in the neighborhood. And too often there is no means of knowing whether the record is the result of one accidental specimen or the summation of a life-history study.

The longer the author studies the food plant relations of the Jassidae the more evidence he finds to support the idea that nearly every species has its particular food plant or group of closely related plants upon which it is almost absolutely dependent in part, at least, of its life cycle. In a large number of species the larvae rarely if ever leave the plant upon which they emerge from the eggs. So that the finding of the larvae in any number upon a plant is in a great many cases an almost absolute test of the correctness of the food plant determination.

The following notes are in many cases extracts from almost complete life-history studies and in every case are based on sufficient evidence to almost preclude the idea of an accidental occurrence.

GENUS MACROPSIS.

The following notes complete the food plant list for our forms of this genus, with the exception of one species, and while the genus as a whole presents a remarkable variety of food plants each species seems to be very strictly confined to its particular plant or group of closely related forms. In fact I have even found the presence of a particular species of Macropsis one of the best guides to the determination of the many varieties of one plant species.

M. lacta Uhl.—This species is found only on the bushy species of Sumac (*Rhus aromatica* and *trilobata*), that occur so commonly on the sides of the foot hills and along the bluffs of the streams out on the plains in Colorado. The larvae appear early in July, hiding in the axils of the leaves and in the fruit clusters. They mature early in August, the adults remaining until the middle of September. They are of a bright, shining green color and thus resemble the petioles and new growth upon which they stay.

Var. *pacta* Ball.—Is a pink variety of this species found only in the crimson fruit clusters of this Sumac, where it is well protected by its resemblance to the fruit stems and also by the sticky nature of the fruit.

M. humilis Stal.—This species seems to be strictly confined to the rayless golden rod (*Bigelovia douglasii* group). The female is of a pale green color, similar to that of the new growth upon which it stays. The male has a shining black stripe down the back and depends upon its agility in dodging around the stems for protection. The adults appear in July, the males having mostly disappeared by August 1st. It is a common species in southwestern Colorado and occurs sparingly well up in the mountains west of Fort Collins, Colo., but has never been taken in the foot hills or on the plains, although the Bigelovia abounds there.

M. robusta Uhl.—This small pale green form is found abundantly on the bushy Atriplex (*A. canescens*) throughout the southern half of Colorado and down into Arizona. The plant appears almost white, but the young shoots and stems where the insects rest are pale green.

M. bisignata Ball.—This pretty brown-marked species occurs on *Gutierrezia euthamiae*, a little yellow-flowered Compositae that grows in small clumps all over the plain region of Colorado and well up into the mountains. There appears to be two broods of this species, one appearing late in May and another in September. The difference in altitude affects the time of appearance so much that it is hard to determine the number of broods except where the same locality is under observation during the entire year.

GENUS PEDIOPSIS

The food plants of a number of our species have already been definitely recorded and a few more are added here. The willow forms, as far as studied, seem to be as strictly confined to one species or group of willows as are the willow-inhabiting forms of Idiocerus.

P. tristis Van D., and *trimaculata* Fitch.—were both injuriously abundant on cultivated plums at Fort Collins, Colo., in 1902. The adults of the latter species appeared the first week in July and those of *tristis* a week or more later.

P. suturalis O. and B.—seems to be strictly confined to the black willows (*Salix amygdaloides* and *nigra*), where it is fairly common locally.

P. erythrocephala G. and B.—An abundant species on the narrow-leaved willow (*S. longifolia*). By an oversight the habitat of this species was omitted in Osb. and Ball's review of this genus. It is known from Iowa, Nebraska, Kansas and Colorado.

P. trivialis Ball.—This species occurs abundantly on the black willows (*S. amygdaloides*) in Colorado. The adults appear by the first of July.

P. viridis Fitch.—This species appears to be strictly confined to the narrow-leaved willow (*S. longifolia*). The adults appear the middle of June.

GENUS IDIOCERUS

The American forms of this group have been recorded from only three genera of plants and these all tree forms. The following notes add as many more genera to the list and introduces for the first time strictly bush forms as host plants. Wherever willow forms have been studied they have been found confined to one species or to a group of closely related species of willows and not general feeders as has been commonly supposed.

I. dolosus Ball.—Found only on the bushy Sumac (*Rhus aromatica*) in the mountain region of Colorado. Adults have been taken from the middle of July until late in August.

I. ramentosus Uhl.—Common on *Salix longifolia*, seeming to prefer the short, thick clumps and sheltered locations. Found in Iowa, Nebraska and Colorado.

I. snowi G. and B.—found on *S. longifolia*.

I. lachrymalis Fitch.—found only on the Quaking Asp (*Populus tremuloides*).

I. femoratus Ball.—is a willow form, but has not been found in sufficient numbers to determine which species of willow it lives on.

I. productus G. and B.—is also a willow form.

I. morosus Ball.—This was swept commonly from two species of *Ribes* growing in the foot hills and mountains west of Fort Collins, Colo. It was most frequently met with on the red currant or squaw berry (*R. cereum*).

I. verrucosus Ball.—was also taken on currants at about the highest altitude at which they grow.

I. ensiger Ball.—This is probably another currant form, though not enough specimens were taken at any one time to eliminate the possibility of it being an accidental capture. There were two very distinct kinds of larvae found together on the squaw berry—one, dark reddish brown that apparently belonged to this species, and a green form that was probably *morosus*.

I. amoenus Van D.—This pretty species lives on the Juniper, where its rufous and green match well with its surroundings.

I. nervatus Van D.—This species has been reported as occurring on willows, but in Colorado it seems to be an inhabitant of the Juniper. It is possible that there are still two species mixed under that name.

The American Association.

We have been interested in noticing the membership of the American Association for the Advancement of Science from the different Universities of the country, as shown by a Geographical list recently published by the Association.

In this list the Institution is given, although possibly not stated in all cases, but on the basis of this list and adding such as are known to belong to the University staff in each case, the numbers run as follows

Columbia, 52, Cornell, 34, Ohio State University, 28; Harvard, 27; Chicago, 24, Yale, 23, Johns Hopkins, 18; Stanford, 17; Wisconsin, 16, Michigan, 15, Minnesota, 15, Indiana, 14; Syracuse, 13; Illinois, 12, Kansas, 12, California, 12, Princeton, 12, Nebraska, 11, Missouri, 10, Iowa, 8, West Virginia, 8, Western Reserve, 8, Case School, 8, Texas, 7; North Carolina, 7, Colorado, 6, Washington at St Louis, 6, Maine, 5, Tennessee, 5, Vanderbilt, 5, Oberlin, 5, Purdue, 3, Virginia, 3; Cincinnati, 1

We note the following for Ohio cities Cleveland, 41; Columbus, 37, Cincinnati, 21, Oberlin, 6, Wooster, 6, Marietta, 5, Akron, 4, Westerville, Delaware, Athens, Alliance, 3 each, Ashtabula, Covington, Hiram, Painesville, Springfield, Tiffin, Toledo, Wilmington, Youngstown, 2 each, Barnesville, Dayton, Defiance, Elyria, Fredericktown, Garrettsville, Gilmore, Granville, Greenville, Hamilton, Mt Vernon, New Carlisle, North Baltimore, Oxford, Plainville, Rushsylvania, Salem, Sandusky, Signal, Urbana, Warren, West Milton, Wheelersburg, Wyoming and Zanesville, 1 each

OHIO MYCOLOGICAL CLUB.

To the Botanical Department came ever more frequent inquiries as to the mushrooms and toadstools and other of the higher fungi It was thought best to devise a plan of response that would be less burdensome and at the same time a better means of furnishing, as far as could be done, the information sought, and perhaps render assistance to people not now nor intending to be students in colleges

Accordingly it was decided to form a Mycological Club, unencumbered by constitution, by-laws, or officers, open to everybody, and with the sole object of mutual help in observing and studying the numerous mushrooms and toadstools—learning them so thoroughly that the different kinds, especially the commoner species, could be accurately identified with a view of using the edible and avoiding the poisonous kinds It was determined to fix the fee at ten cents—low so as not to be burdensome to anyone—and strong hope was entertained that with the income so obtained several bulletins could be issued during the season.

All who were consulted permitted their names to be entered as charter members, and the Ohio Mycological Bulletin, No. 1, was issued. The members now number over 200 and the membership cards are still being received. It is interesting to observe that the list includes school pupils, college students, many amateurs, professional botanists (among these several eminent American Mycologists,) business and professional people—not confined to Ohio but from the whole country

The first four-page bulletin gave a few introductory and explanatory paragraphs, nine figures illustrating the general appearance of the commoner groups of mushrooms, namely, the Gill-fungi, Pore-fungi, Spine-fungi, Coral-fungi, Carrion-fungi, Puffballs, Earthstars, Cup fungi, and Morels. Three illustrated books noticed, suggestions to teachers, a paragraph on the Gill-fungi, and the list of seventy-six charter members are the other contents of the first number

Bulletin No 2 has just appeared Besides explaing the make-up of a botanical name, giving directions for sending specimens, and the second list of members, the Morels are discussed and illustrated by two full-page plates, showing the plants natural size.

All the botanical names and the uncommon descriptive words used in the bulletin are divided into syllables, and the accented syllables marked All matters are made as clear as possible All who may be interested in the mushrooms or who desire the bulletin are invited to join the club, sending their names with fee to the Professor of Botany, O S U, Columbus, O —O M B

Meeting of the Wheaton Club.

The Club met Monday evening, March the 16th, in Biological Hall After a short business session the Club proceeded to an examination and discussion of the list of earliest spring migrations for Columbus, published in the February NATURALIST Comparison with the migration dates of Dr Wheaton showed in most cases a close connection, although there were several records differing quite widely The record of the kingbird, *Tyrannus tyrannus*, was found to be based on a mistake in the records of the Club Discussion brought out the fact that several of the dates given were antedated by observations of the members which had not been reported and were therefore not available when the list was made up The new records are given below

Barn Swallow, April 14
Rose-breasted Grosbeak, April 22
Orange crowned Warbler, April 22
Maryland Yellow-throat, April 20
Rough-winged Swallow, April 24
Olive-backed Thrush, April 26
Warbling Vireo, April 20.
Whip-poor-will, April 29
Kentucky Warbler, April 30
Great crested Flycatcher, April 29
Black-billed Cuckoo, May 5
Blue-headed Vireo, April 30
Prothonotary Warbler, April 28
Yellow-billed Cuckoo, April 27

After the discussion, reports of personal observations were made, Mr. Dawson reporting the Goshawk for March 15th. The Club then adjourned to meet April 20th

WALTER J DERBY, *Secretary*.

MEETING OF THE BIOLOGICAL CLUB.

ORTON HALL, February 2, 1903.

The first paper was given by Prof. Dresbach, on "Some Peculiar Variations in Blood Corpuscles" He reported finding a person whose blood corpuscles are elliptical Their dimensions are as follows.

Greatest width, 4 8μ Greatest length, 10 3μ.
Average width, 4.1μ Average length, 10 μ.
Average thickness through center, 1 3μ.
Average thickness through edge, 2 7μ
Ratio of width to length, from 1 2 to 1 3 1.
The average human corpuscle is 7 2μ to 7 8μ in diameter.

The second paper of the evening consisted of a review of the life of Pasteur, by Mr Landacre. After dealing with the main facts of his life, especial emphasis was laid on two phases of it, first, the directness of his method in research Almost every great discovery Pasteur made was first undertaken as the result of influences brought to bear on him by others The reasons for beginning researches with him were usually economic His life seems to be a refutation of the current belief that the best scientific work can be done by allowing each man to follow his own inclination Second, there was a remarkable sequence in his researches Each one grew out of the preceding problem. And yet it was always the practical side of a problem that attracted his attention

Under personal observations, Dr Kellerman spoke of the abundance of *Chaerophyllum procumbens* along the Olentangy He noticed that almost every plant was very badly infected with a black rust. They have a red rust in spring and later a black rust, but it is unusual to find them infected in winter. He also spoke of his inoculation experiments with rusts and gave a summary of his paper, which is published as a University Bulletin, Series 7, No. 11 (Botanical Series, No 12.)

Mr. Mead reported on the examination of the flora of a mound near Chillicothe. It had been reported that there were some peculiar plants growing near it. His investigations, which included the determination of the whole flora, showed, however, that there were no plants present the occurrence of which was at all unusual.

Prof Schaffner exhibited some mangrove embryos from Florida and remarked upon the habits of the plant

Prof Osborn gave a note on a report concerning the campaign against mosquitoes on Long Island. This is published on p 377 of the February number of THE NATURALIST.

ROBERT F. GRIGGS, *Secretary.*

The Ohio Naturalist,

PUBLISHED BY

The Biological Club of the Ohio State University.

Volume III APRIL 1903 No 6

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FURTHER NOTES ON SOME CLIMATIC CONDITIONS OF OHIO

OTTO E JENNINGS

An attempt was made in a former article* to present in brief form some of the conclusions reached in a study of the climatic conditions of Ohio from an ecological point of view. Further work along this line has shown that a more extended compilation of data is very desirable if not actually necessary in anything approaching a comprehensive study of Ohio climate as an ecological factor.

So in order to get a better basis for study data were compiled relative to (*a*) wind velocity and direction, (*b*) relative humidity, and (*c*) average date of first and last killing frost of the season.

WIND —DIRECTION AND VELOCITY

Plate 12 Map IX

In attempting to derive as accurate general averages as possible, use was made of records as taken by self registering instruments of the U S Weather Bureau stations at Cincinnati Columbus, Cleveland Toledo Sandusky and Pittsburg. These records extend back to 1892, thus giving readings of ten consecutive years.

As generally supposed the prevailing direction of the wind in Ohio is south west. The direction in the region of Cincinnati seems to be very uncertain, it is given on our map as south west based on averages reported by the U S Weather Bureau in 1896 for a period previous to that date, but for the period 1892 to 1902 the prevailing direction has been south east so that there is no very decisive evidence in favor of any particular direction Cleveland shows a prevailing south east wind, but Pittsburg is decidedly a station of north west winds

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*OHIO NATURALIST 3 339 345 Jan 1903

For most of the stations the windiest month of the year is March and the calmest month August, although Cleveland s highest winds are in November In the course of the year there are some interesting variations in wind direction at some of the stations as the table below will show At the three lake stations the wind seems to show during the earlier part of the year a tendency to veer to a more westerly direction than is taken during the later months

WIND DIRECTION AND VELOCITY

STATIONS		Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean for the year
Cincinnati	Prevailing direction	s w	n w	n w	se	n w	se	s w	n e	se	se	se	se	s
	Miles per hour	5 7	[illegible] 2	9 3	8 4	7 1	6 3	6 4	5 7	6 2	6 4	8 2	8 [illegible]	7 5
Columbus	Prevailing direction	s w	w	w	n w	s w	s w	s w	s w	n w	se	s w	s w	s w
	Miles per hour	0	9 5	9 9	[illegible]	7 5	6 [illegible]	6 5	[illegible] 0	6 6	7 1	8 [illegible]	9 6	8 1
Cleveland	Prevailing direction	s w	s w	w	se	se	se	se	se	se	se	se	s w	se
	Miles per hour	15 6	15 4	15 2	13 4	12 5	1 0	10 [illegible]	10 [illegible]	13	4 1	1[illegible] 5	1[illegible] 1	13 7
Toledo	Prevailing direction	w	w	w	n w	w	w	s w	s w	s w	s w	s w	s w	s w
	Miles per hour	11 1	11 [illegible]	11 6	11 4	9 8	9 3	8 7	7	8	[illegible] 3	11 1	0	0 0
Pittsburg	Prevailing direction	n w	n w	n w	n w	n w	n w	n w	n w	n w	n w	n w	n w	n w
	Miles per hour		7 [illegible]	7 6	6 9	[illegible] 0	5 6	5 2	4 8	5 5	6	7 1	7 1	6 5
Sandusky	Prevailing direction	s w	w	s w	e	s w	s w	s w	n e	s w	s w	s w	s w	s w
	Miles per hour	[illegible] 4	9 7	0 3	9 4	8 [illegible]	7 4	7 [illegible]	[illegible]	7 6	7 8	[illegible] 8	9	8

KILLING FROST,—DATE OF FIRST AND LAST

The date of the last killing frost in the spring and the first one in the fall is perhaps to be ranked as one of the most determinative factors in ecology since upon it depends in a measure the length of the growing season

The data used in this compilation cover a period of ten years for most of the stations, although many of these have only partial records for the earlier years Records from twenty eight stations throughout the State were used, but the results are so conflicting that only a few general conclusions can now be stated

In a general way the immediate Ohio valley shows a longer growing season than the central part of the State, but about the same length of season as the region immediately adjoining the lake Sandusky, with a growing season of 201 days and Marietta with 186 days, stand at one extreme, while Hillhouse (Lake county) with 131 days, and Bowling Green and Defiance, each with 141 days, stand at the other extreme

FIRST AND LAST KILLING FROST

STATIONS	Last Killing Frost in Spring	First Killing Frost in Fall	No Days in Growing Season	STATIONS	Last Killing Frost in Spring	First Killing Frost in Fall	No Days in Growing Season
Akron	Apr 23	Oct 7	167	Greenville	Apr 24	Oct 8	167
Ashland	Apr 27	Oct 9	165	Hillhouse	May 18	Sept 26	131
Ashtabula	Apr 23	Oct 10	170	Marietta	Apr 16	Oct 19	186
Bowling Green	May	Sept 25	141	Milligan	May 5	Sept 5	144
Canton	Apr 25	Sept 30	158	Montpelier	Apr 28	Sept 25	151
Cincinnati	Apr 14	Oct 18	187	New Alexandria	Apr 27	Oct [illegible]	[illegible]
Clarksville	Apr 20	Oct 2	[illegible]	Norwalk	May 9	Oct [illegible]	[illegible]
Cleveland	Apr 2	Oct 21	153	Pomeroy	Apr 19	Oct 5	169
Columbus	Apr 15	Sept 21	156	Portsmouth	Apr 16	Oct 11	178
Dayton	Apr 21	Oct 8	[illegible]	Sandusky	Apr 11	Oct 29	201
Defiance	May 5	Sept 23	141	Tiffin	Apr 28	Sept 18	143
Elyria	Apr 24	Oct 8	167	Toledo	Apr 18	Oct 13	178
Findlay	Apr 30	Sept 30	153	Van Wert	Apr [illegible]	Oct 2	158
Granville	Apr 21	Oct 1	163	Wooster	May 5	Sept 29	147

RELATIVE HUMIDITY

Plate 12 Maps X XI and XII

By the term relative humidity is meant the relation (ratio) of the amount of moisture actually present in the air—at any given conditions of temperature and pressure—to the amount of moisture necessary to produce saturation under the given conditions This ratio is usually expressed as a percentage This is not to be confused with the *absolute* humidity which is simply a statement of the amount of water present without reference to the saturation point and is usually expressed as so much weight or volume per unit of air

The observations for relative humidity are taken at a few scattered stations only as compared to many other phases of the weather, and so the stations are farther apart than desirable for close work The daily averages are derived from observations taken at 8 A M and 8 P M seventy fifth meridian time and inasmuch as the relative humidity depends to a large extent upon the temperature of the air it is evident that the relative humidity during the warmer hours of midday may be an altogether different thing than the averages given would indicate The averages as derived from Ohio conditions probably fall short of giving the actual contrast between the Lake Erie stations and those in more central or southern portions of the State so that it perhaps devolves upon us to make the most possible of any differences apparent

Just to what extent we must reckon with relative humidity as an ecological factor is pretty difficult to determine In the case of plants it must be of some ecological importance even in winter If the soil about the roots of some of the trees exposing much surface to the air—as the evergreens—be frozen or so cold that root action is practically nothing, then evaporation into an air of low relative humidity may take place to such an extent as to prove injurious. No water is taken by the roots from the soil to take the place of that evaporated. During the growing season the effect of a low relative humidity, as in case of hot, dry winds, is too well known to need further comment.

The relative humidity of the Northern and Western United States is from five to ten per cent higher in winter than in summer, but in the Gulf States and lower Atlantic States conditions are fairly constant the year through. The highest relative humidity is to be found along the northern Pacific coast and to the east and southeast of Lake Superior. The westerly air currents rising from the Pacific to the crest of the mountains are considerably cooled and saturation is produced to such an extent that much of the moisture is precipitated and never gets over the mountains. In this manner a high relative humidity is brought about along the coast.

In the case of the Great Lakes we have another factor in operation. The westerly air currents in drifting across the waters are often considerably cooled and also take up more or less moisture, so that a region of high relative humidity must result east of the lakes.

Ohio presents some rather peculiar conditions with respect to humidity. As may be seen in the plate, the January map shows a streak coming down from the northwest and traversing the State diagonally in which the relative humidity is above eighty per cent. The air in that streak is just as "moist" as the air of Florida. From Map II of the January article referred to it may be seen that this streak includes that part of the State having the least total annual precipitation, and only a small part of those sections of the State having the greatest annual precipitation. The total annual precipitation and the relative humidity appear to have no connection whatever.

Turning again to the January article, Map VII shows that during winter the least average minimum temperatures occur in the northwestern and central portions of the State, and are central in the region of high relative humidity. The inference to be drawn is that the higher relative humidity results from the lower temperature. It is not readily apparent, however, why this region should have its longer direction at right angles to the prevailingly southwestern direction of the winds, but perhaps this may be due in some measure to the difference in temperature of winds from different directions. The general direction of storms in our region is from west to east. Around the areas of low barometric pressure, usually the warm stormy areas, the winds revolve in a counter-clockwise direction, while around areas of high barometric pressure, those of clear cold weather, the revolution of the wind is in the same direction as that of the hands of a clock Thus the winds in advance of a "Low," as the low-pressure areas are termed, are warmer, and with us in Ohio usually southerly or southwesterly, while the winds in advance of the high-pressure area following the rainy "Low" are from the north or northwest and colder It is probably due to such cold northwest winds blowing over a region left moist and warm by the preceding storm that the areas of low temperatures can be traced in a northwest to southeast direction, and so likewise the area of high relative humidity, if determined indirectly by the same cause, would follow the same direction.

In July, which we may take as being about the middle of the growing season, Ohio again presents some interesting problems in connection with its relative humidity The main body of the State has an average of between sixty-five and seventy per cent (Map XI) The highest per cent. is in the southeast, while in the western part, and extending over southern Indiana as well, is a section with a relative humidity for July of less than sixty-five per cent For July this is the driest region in the United States east of Kansas or Nebraska. The region is not in the right position, with prevailing southwest winds, to derive any benefit from the Great Lakes, and the atmosphere is apparently pretty well dried out after its passage over the broad, level region to the west

The following tables were taken from the Report of the Chief of the U S. Weather Bureau, 1901-1902, and include the period 1888 to 1901

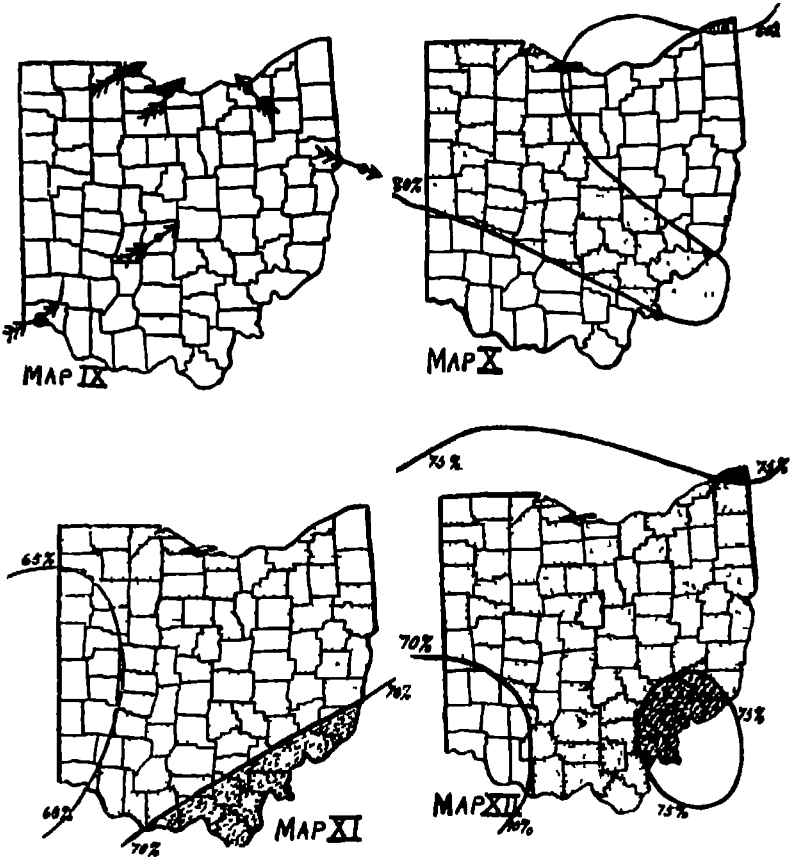
MONTHLY AND ANNUAL MEAN RELATIVE HUMIDITY.

STATIONS	Average Per Cent in Each Month												Annual Mean	Least Monthly Per Cent		Greatest Monthly Per Cent	
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec		Month	Amt	Month	Amt
Toledo	82 4	80 4	75 5	69 1	69 0	69 9	67 1	70 1	72 2	73 3	77 6	79 9	73 9	July	67 1	Jan	82 4
Sandusky	79 8	78 6	75 4	69 4	69 1	70 9	67 7	69 4	70 4	71 0	74 8	76 6	74 4	July	67 7	Jan	79 8
Columbus	80 2	78 0	73 8	66 7	67 9	69 1	66 9	69 9	70 3	71 8	77 0	79 0	72 6	July	66 9	Jan	82 0
Cleveland	77 6	77 2	75 1	70 0	71 1	70 6	68 2	70 5	72 8	72 4	74 0	75 0	72 9	July	68 2	Jan	77 6
Cincinnati	76 6	73 6	70 0	62 0	64 4	64 8	64 8	66 8	68 0	68 9	72 9	75 4	69 0	Apr	62 0	Jan	76 6
Detroit	82 7	80 6	76 4	69 6	69 5	69 6	66 9	69 8	73 4	74 8	78 6	81 3	74 4	July	66 9	Jan	82 7
Pittsburg	78 9	77 2	75 0	68 4	69 2	69 7	67 8	69 0	71 4	69 1	74 8	75 9	72 2	July	67 8	Jan	78 9
Indianapolis	77 9	76 2	70 9	64 4	66 0	66 5	62 8	65 1	67 0	67 7	71 5	75 0	69 2	July	62 8	Jan	77 9
Erie	80 9	82 4	79 5	77 1	74 4	73 0	69 3	71 1	73 3	73 1	76 6	78 9	75 5	July	69 2	Feb	82 4.

Now, with regard to the application of some of the foregoing conclusions to ecological work, it must be remembered that deficiencies of one factor may often be counterbalanced by a surplus of another factor. It is thus necessary to consider the factors collectively as well as individually. In the ecology of Ohio it is doubtful if more than a very few of the phases of species distribution can be explained from the standpoint of any one factor alone It is not to be assumed that all the climatic factors of ecological connection have been considered in these two articles, and neither does it follow that any of the factors have been considered in all their possible phases as related to ecology, but yet enough has been considered to afford more or less of a basis for further work. It is to be regretted that the edaphic conditions, such as soil moisture, soil texture, etc , are not more completely worked out for Ohio They take a very important part among the ecological factors, and in many cases are almost inseparably linked with meteorological factors

For a concrete instance of some of the problems of plant ecology, comparison may be made, for instance, between Ashtabula and Cincinnati, although localities differing more widely may be found in the State The two stations have the same average range (100° Fahr.) between the average minimum and maximum temperatures, but Cincinnati is five degrees warmer in mean annual temperature, thus having decidedly an advantage as to the needs of many plants The annual precipitation is the same in both localities, but Ashtabula has sixty inches of snow to less than twenty inches for Cincinnati Now, perhaps for many plants the protection offered by the extra forty inches of snow at Ashtabula is a greater advantage than is the extra five degrees of temperature at Cincinnati Again, the monthly distribution of the precipitation is another important factor—Cincinnati has a maximum of 5 69 inches in March, while Ashtabula has a maximum of 6 95 inches in July, at about the middle of the growing season and just when needed for the majority of plants Furthermore, Cincinnati has a very drying atmosphere (low relative humidity) as compared with Ashtabula, but to counteract this the higher wind velocity at Ashtabula indicates the ability of the air to carry away more water. Cincinnati is farther south and would thus be more directly under the sun's rays, but Ashtabula has less cloudy weather and so perhaps gets more sunlight than does Cincinnati

In problems like the above, where each climatic factor may have some certain influence upon any particular species, a debit and credit account might be imagined in which the factors are balanced, and if something is known of the requirements of the species; perhaps some light might be thrown upon the problems of distribution or the possibilities open to introduced species.



JENNINGS on "Some Climatic Conditions of Ohio"

EXPLANATION OF MAPS

Map IX Wind Direction Arrows denote prevailing direction of wind

Map X Normal Relative Humidity for January Shaded portion has a relative humidity of above 80 per cent., the unshaded portion, below 80 per cent

Map XI Normal Relative Humidity for July More heavily shaded portion represents regions having a relative humidity of above 70 per cent, the less heavily shaded, between 65 and 70 per cent, and the unshaded, below 65 per cent

Map XII Normal Annual Relative Humidity More heavily shaded portion denotes a relative humidity of 75 per cent or above, less heavily shaded portion, 70 to 75 per cent, and unshaded portion, less than 70 per cent

OHIO PLANTS WITH CONTRACTILE ROOTS.

JOHN H. SCHAFFNER.

One of the interesting phenomena to be observed in studying geophilous plants is the habit which some have of keeping certain parts of their body below the surface by means of contractile roots. This subject has received the attention of DeVries, Rimbach and others, whose papers should be consulted for a more complete presentation of the subject.

The burrowing habit may be of advantage in several ways. Many seedlings possess contractile roots, by means of which they reach a suitable depth of soil. In certain plants which produce stolons or runners, root contraction is also an important factor. When the stem touches the ground it strikes root and is soon pulled beneath the surface.

Rhizomes may develop horizontally, at right angles to the direction of gravity, without being influenced in a mechanical way. There are, however, many, like the long rhizomes of *Iris versicolor*, which are continually growing upward, but contractile roots developed on the under side continue to pull them down into a horizontal position. In such forms as *Trillium grandiflorum* the short rhizome is not only kept horizontal, but is buried deep in the earth by the strong contraction of the numerous long roots growing out of the under side.

There are rhizomes and bulbs which develop vertically, and would thus grow out of the ground. But as the stem elongates or dies away below, the newer part is pulled backward by a whorl of contractile roots which grow out on the young nodes near the upper end. Very striking examples of this type are *Botrychium obliquum* and *Spathyema foetida*.

In some plants there is a main tap-root which continues to contract for a long time, and thus keeps the growing points at or near the surface. This may occur in acaulescent herbs or in crownformers like *Aquilegia canadensis* and *Taenidia integerrima*.

The following plants have prominent root contraction.

Botrychium obliquum
Botrychium dissectum
Arisaema triphyllum
Arisaema dracontium
Spathyema foetida
Zygadenus elegans
Veratrum woodii
Hemerocallis fulva
Trillium sessile
Trillium recurvatum
Trillium nivale
Trillium grandiflorum
Trillium erectum
Trillium cernuum.
Trillium undulatum
Hypoxis hirsuta
Iris versicolor
Iris hexagona.
Allionia nyctaginea
Aquilegia canadensis
Aquilegia vulgaris.
Gentiana andrewsii
Plantago major.
Taenidia integerrima
Laciniaria squarrosa
Mesadenia tuberosa
Taraxacum taraxacum.
Taraxacum erythrospermum

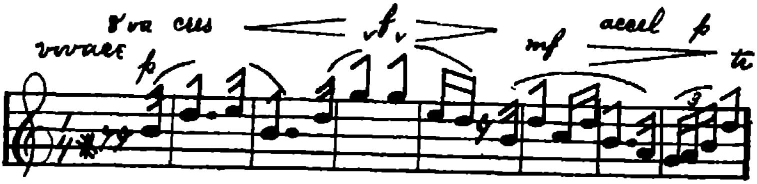
THE SONG OF THE FOX SPARROW.

THEODORE CLARKE SMITH

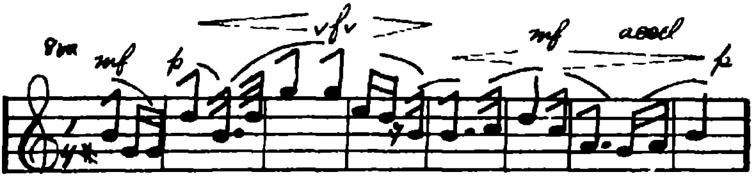
The study of the song of the fox sparrow is a highly tantalizing pursuit owing to the bird's brief stay, provoking habits of silence and reluctance to sing in full voice. In three years, taking into account the fall as well as the spring migrations, I have heard them sing scarcely a dozen times, although I have never failed to see them in considerable numbers Nevertheless, the impression produced by these few occasions is such as to place the fox sparrow among the first vocalists of his family

The song form commonly heard may be represented by the following

A



B



This notation is not ventured with any assurance of perfection for the song is so rapid, so syncopated in its tempo and the tone so sliding and lacking in precision that its reproduction is attended with great difficulties. The matter of pitch presents an insoluble problem The fox sparrow's pitch is entirely free, he does not sing in the conventional human scale but employs intervals of other dimensions than our whole and half tones, which can not be represented on our musical staff In trying to reproduce the song there has to be continual slight adjustment and rectification, so that the result is at best only an approximation to the real sounds, more regular and mechanical, less bird-like

Under these considerable limitations the notes above given may be taken to suggest the song form of the fox sparrow, a theme from which different birds vary a good deal without however departing from the general scheme. The accented high notes in the fourth bar (*A*) seem to be the musical kernel of the song, for they remain substantially unaltered with different individuals however much the introductory or concluding bars may diverge.

The second theme (*B*) illustrates this variety I have five or six independent songs among my notes, but every one contains that particular sequence

The tempo was decidedly rapid, the eight bars not occupying over four seconds in utterance and producing an impression of vigor and dash During this lively delivery the loudness was noticeably modified In the common form of the song there was a sharp crescendo on the first two bars to a maxium on the high notes followed by a diminution on the fifth, then a slighter rise and lastly a diminuendo on the final bars This feature is characteristic of the sparrows and is one of the chief charms of their singing

The fox sparrow sings, it is clear, a real "tune" with expression and variety, a rapid little melody suggesting dance music of a pastorial character But were this the only charm to notice he could not be ranked above the song, vesper or field sparrows, and in fact as ordinarially heard the fox sparrow does not produce any impression of superiority As a rule during the migrations—always, as far as I have observed, in autumn—the fox sparrow sings in a half voice with perfect distinctness, but without volume or resonance He gives the notes above figured with a somewhat chirping articulation, although never sharply staccato, sometimes twittering and occasionally trilling a little toward the end Heard when singing in this fashion simultaneously with the song and vesper sparrows he is more flowing but not superior in form and is less brilliant in execution But let the fox sparrow be moved to use his full voice and the whole song is transformed. Three times only have I heard this happen, but the effect was decidedly startling and it made a lasting impression On two of these occasions the birds remained in full song for several minutes and from these my observations are taken In the first place the whole enunciation is altered, the notes are no longer chirped but poured out in a series of full sustained tones which run into one another so that the song becomes a legato warble The form remains unaltered, the tempo the same, the pitch is not changed but the different delivery makes it seem like a wholly new song. Under this form of utterance the vocal modulation becomes much more noticeable, the crescendo to the high notes and the quick drop after them more effective. It is this feature which gives a decidedly emotional quality to the song It suggests the human voice for it surpasses in range and suddeness of change anything in the power of a wind instrument

The voice of the fox sparrow in its full power is clear, sustained and rendered rich by overtones It has not of course the metallic vibrant ring of the thrushes or the bobolink, it is rather the sparrow or finch voice at its best, a whistle full of sweetness with continual accompanying changes in timbre

Unlike most of the sparrows the fox sparrow displays an ability to let his notes drop into one another by a quick flexible slide, usually accompanied by a slight change in timbre, which is the characteristic of the warbling birds such as the vireos—in this respect he surpasses all of his race that I have ever heard except the rose breasted grosbeak and the cardinal.

One of the most interesting circumstances connected with the three occasions when I have heard the full song was the fact that each time opportunity was abundantly given for direct comparison of the fox sparrow with the strongest singers of the early spring. Not only the song, vesper, field and tree sparrows and juncos were singing, but tufted titmice, Carolina wrens, meadow-larks, cardinals, bluebirds and robins, with all of these the fox sparrow held his own. He quite overpowered the other sparrows by his vocal strength and surpassed the wren and titmouse in musical form. Only the meadowlark, robin and cardinal were noticably louder and of all the singers only the cardinal, meadowlark, wren and bluebird were comparable in sweetness and richness of tone. The bluebird came the nearest in quality. One of them perched not thirty yards from the sparrow and sang vigorously as if in answer or rivalry. The two songs were not wholly unlike in warbling character and bore much resemblance in timbre but the sparrow was undeniably sweeter, more sustained, more elaborate and more vivacious.

As compared with the wren or cardinal the sparrow was less round and clear in his tones but was equally spirited and musically much more interesting. To match him in all respects one would have to induce a rose-breasted grosbeak to sing the vesper sparrow's theme; to surpass him one would have to call upon one of the major singers, the thrasher, the bobolink or the thrushes.

CHIONASPIS GLEDITSIAE. (New Species.)

J. G. Sanders.

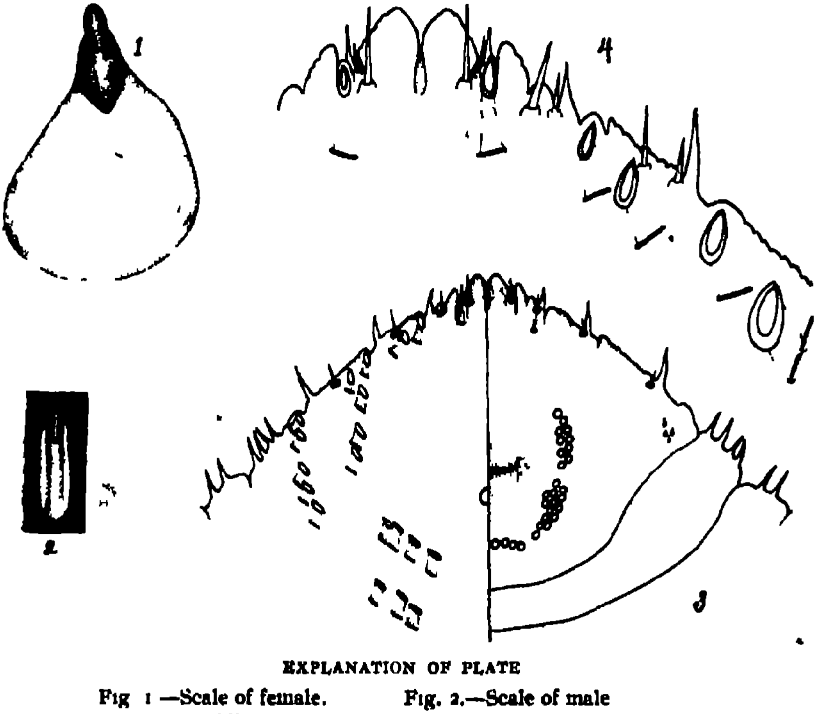
Scale of Female.—Figure 1. Length 1.5—2 mm. Irregular in form, usually very broad posteriorly, somewhat convex, Of rather firm texture, dirty white, usually blackened and inconspicuous on host. When removed, a conspicuous white patch is left.

Scale of Male.—Figure 2. Length .6—.8 mm. Sides parallel, strongly carinated. Exuviae pale yellow, occupying about one fourth of the scale.

Female.—Figures 3 and 4. Broadest toward posterior end, segments prominent. *Median lobes* short, broad at base, tapering sharply, and serrate. The mesal margins approach at base and apparently fuse, forming a small, club-shaped thickening extending anteriorly. Inner lobule of *second lobe* very long and narrow, serrate, extending posteriorly two-thirds of length of median lobe, and separated from it by almost its own width. Outer lobule rudimentary, rounded. *Third lobe* rudimentary, lobules faintly serrate. The *gland-spines* are arranged as follows: 1, 1, 1, 1, 3-4, large and conspicuous, decreasing in size toward the median lobes. *Spines* on dorsal surface are arranged as follows: 1st on base of median lobe, laterad of center, 2nd at base of second lobe, between the lobules; 3rd at base of third lobe; 4th about two-thirds of distance to penultimate segment, posterior from the fourth gland-spine. On the ventral surface the spines are shorter and located just laterad of the corresponding dorsal spine. First and second rows of *dorsal gland-orifices* are absent, third row represented by 3-5 in the anterior and 3-6 in the posterior group; fourth row with 2-4 in anterior and 5-7 in posterior group. Median group of *circumgenital gland-orifices*, 4-10; anterior laterals, 15-21, posterior laterals, 8-14.

Habitat. Abundant on *Gleditsia triacanthos* (Honey Locust), at Columbus, Ohio.

[The author wishes to thank Prof. Cooley for his expert-opinion on this species, and also for his many favors.]



EXPLANATION OF PLATE

Fig. 1.—Scale of female. Fig. 2.—Scale of male.
Fig. 3.—Pygidium of female. Fig. 4.—Part of Fig. 3, enlarged.

AN AMERICAN MEMOIR ON ETIOLATION STUDIES

A D SELBY

MacDougal Daniel Trembly Ph D The Influence of Light and Darkness Upon Growth and Development Memoirs of the New York Botanical Garden Vol II pp XIII and 320 with 174 figures in the text New York 1903 published by the Garden by the aid of the David Lydig Fund

In the latest volume of the Memoirs of the New York Botanical Garden Dr MacDougal publishes the results of experimental observations on etiolation begun in 1895 and continued till the close of 1902 Those from 1895 to 1899 were made at the University of Minnesota in portable dark chambers from 1899 to 1902 in a specially constructed dark chamber in the Museum Building of the New York Botanical Garden Ninety seven species belonging to diverse classes have been cultivated in continuous darkness with control plants in the ordinary alternation of day light and night The species studied include aquatics creepers climbers succulents mycorrhizal forms geophilous plants and aerial shoots mesophytes and spiny xerophytes These constitute the most comprehensive series of etiolation studies ever undertaken by a single individual so far as known to the writer

The details with respect to the several species are presented on pages 35 to 200 preceded by a historical resume of described etiolation phenomena from Ray (1686) and Hales (1727) to the present day and followed by discussion of the various features of the results covering 109 pages also an excellent index

One result of Dr MacDougal s investigations has been to show the error of earlier investigators who attributed to light a retarding effect upon growth His results have also contributed to the complexity of the phenomena Many other of the older generalizations aside from the one already named must be modified in the light of his researches It has been found that a large number of herbaceous biennials and perennials do not show an excessive elongation of the stems or shoots in darkness To these belong *Aster divaricatus Cypripedium montanum Galium circaezans Ipomaea batatas Phytolacca decandra Saururus cernuus* and *Lagnera stellata*

The effect of etiolation upon leaves is treated under the following heads

Sterile and spore bearing leaves of pteridophytes

Etiolation of leaves of monocotyledons with parallel venation

Etiolation of petiolate leaves of monocotyledons with open or reticulated venation

Etiolation of leaves of dicotyledons arising from subterranean stems or bulbs

Leaves of dicotyledons arising from aerial stems

All the bearings of the work upon our conceptions of the phenomena of etiolation cannot be touched in a brief review The following extract from page 228 may be of interest

> It is to be seen therefore that the phenomena of etiolation rest upon and consist in the behavior of plants consequent upon the absence of the morphogenic influence of light Some species show an adaptation to this absence of light or to the positive influence of darkness by which the shoots or petioles are elongated in such a manner as to constitute an effort to escape from darkness or to attain illumination

Someone has suggested that etiolation gives us a means whereby we may determine which are the primitive elements of certain plant organs For example with leaves the stipules persist in comparison with the leaf blade In such a case the completeness of the etiolation will influence the results The present memoir will appeal to American botanists interested in the subject containing as it does important contributions to our knowledge

THE GENUS PEDITIA WITH ONE NEW SPECIES

JAMES S HINE

The genus *Peditia* includes some of the largest of our Tipulidae The antennae are each composed of sixteen segments The palpi each have three segments of which the last is whiplash like and much longer than the other two taken together The auxiliary vein ends in the costa The anterior crossvein is very oblique and is in nearly the same straight line with the inner margin of the discal cell and the posterior crossvein

When Osten Sacken published Part IV of Monographs of North American Diptera he mentioned one species of the genus from this continent but in his Western Diptera he described another Therefore at the present time there are two recognized species described from America one from eastern and one from western United States In Psyche Volume VII 201 Aldrich discusses these species and figures the wing of one of them In the same volume page 229 Osten Sacken gives some statements from his manuscript notes in which he gives further observations on his west coast species and states that in Bigot's collection he has seen a *Peditia* with a very extraordinary modification of the coloration of the wings and mentions especially a broad brown border running along the posterior margin of the wing from the root to the apex

There is before me at the present time a very fine specimen which suggests the last mentioned insect and which was taken at Port Renfrew British Columbia July 27 1902 by R C Osburn who was at that time teaching zoology at the Minnesota

Seaside Station. As Osten Sacken did not suggest a name for the species, and as I cannot find it described elsewhere, I desire to give it the following:

PEDICIA MAGNIFICA N. SP.

Color of body and legs light brown; wings conspicuously marked with clear brown. Palpi brown, third segment of each more than twice as long as the first two combined; eyes dark brown; a conspicuous brown stripe on each side of the thorax before the wings. Knobs of halteres brownish; wings with wide brown costal and posterior margins and with a broad stripe of the same color starting at the base and following the fifth vein to where it meets the brown border of the posterior margin, then turning and following the posterior crossvein, the vein at the inner margin of the discal cell and the anterior crossvein and thence to the apex of the wing, including the whole of the first submarginal cell. Middorsal stripe on the abdomen rather narrow, slightly darkened but not conspicuous; male forceps short, irregular in form, emarginate at the tip and the inner side at apex rather prominent and furnished with a number of short black spines. The brown markings of the wings are much wider than in any other species that I know, therefore the hyaline spaces are correspondingly narrowed. Total length of the body 33 mm.; of wing 28 mm.

Habitat: Port Renfrew, B. C. Described from a single male specimen.

The following key may aid in separating our North American species:

1. Male forceps long, about four millimeters ..... *obtusa* Osten Sacken.
   Male forceps short, less than two millimeters 2
2. Posterior border of wing hyaline ..... *albivitta* Walker.
   Posterior border of wing brown ..... *magnifica* Hine.

There appears to be a variation in some of the species regarding the extent of the brown margin of the fifth vein. Sometimes that part of this vein beyond the posterior crossvein is not margined at all. Osten Sacken has reported such a variation in the European species *rivosa* and both he and Aldrich have noted the same in *albivitta*; therefore the former has intimated that Walker's *contermina*, which differs from *albivitta* only in this particular, is a synonym of the latter species. Walker also describes a species that he calls *gracilis* without locality, that so far as I know has not been recognized. It does not agree with any of the American species.

Beling has described the immature stages of *rivosa* in Europe. He found the larvae living in and around brooks and springs, also in springy, wet or damp places in mud and earth. Judging from their very strong mandibles they prefer to feed on animal food, such as the larvae of water beetles. The adults appear mostly in the latter part of August and during September, but occasional individuals may sometimes be seen earlier.

I find no account of the early stages of any of our species.

INTERESTING SPECIMENS OF SPECULARIA PERFOLIATA

EDO CLAASSEN

Peculiar specimens of this plant were found on sandy soil forming a thin layer on a horizontal sandstone at the Thompson Ledges Geauga County O They are very unlike those usually found their stems being often quite procumbent 20 to 100 mm long wiry thread like and somewhat hairy The lower leaves are round petioled and often opposite the upper are roundish or oval decurrent into the short petiole the uppermost sessile roundish cordate clasping and alternate All are more or less crenate and ciliate hairy flowers 1 to 3 in the axils of the leaves calyx unequally 3 4 lobed corolla none or rudimentary (?) capsules opening from below the middle into two uplifted valves seeds lenticular Some of the capsules furnished a few seeds which were sown several years later in a more fertile soil in order to ascertain the shape and size of the plants when grown under more favorable conditions Only a single seed germinated producing a plant very different from those collected on the rock having a stronger and larger upright stem During its growth it was ascertained that like those described above it had the lower leaves petioled but not (as Gray s and Britton & Brown s Manuals say) all cordate clasping A number of measurements of the leaves and their petioles were taken which showed that the six lower ones were petioled and the lowest two were almost round while the next four were oval or even spatulate

The following table shows the measurements taken

LEAVES	Length of Leaf	Width	Length of Petiole
1st	5 mm	4 mm	2 mm
2nd	14 mm	9 mm	9 mm
3rd	18 mm	not measured	7 mm
4th	17 mm	not measured	3 mm
5th	11 mm	not measured	2 mm
6th	10 mm	not measured	1 mm
7th	10 mm	not measured	0 mm

8th and following ones not measured all cordate clasping and without petioles

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GALLS AND INSECTS PRODUCING THEM.

MELVILLE THURSTON COOK

PART III LATERAL BUD GALLS

In Part II of this series of papers I gave a discussion of apical bud galls The lateral bud galls differ from the apical only in point of location, therefore, this (Part III) may be considered a continuation of Part II There is, however, considerable difference in the galls dependent upon the order and genus to which the insect belongs and to the part of the plant which is attacked by the enemy These differences may be summed up briefly as follows

(1) Affection of the tip of the stem causing it to remain in its incipient condition and the leaves to remain aborted, instead of lengthening. This is well illustrated by the apical bud galls of *Cecidomyia solidaginis* Lw on Solidago, *Cecidomyia salicis strobiloides* O S on Salix, and *Callirhytis clavula* Fitch on Quercus alba (Part II, Figs 31, 32, 33) In these cases we have two orders of insects represented but producing similar galls this, as previously explained, is no doubt due to the fact that the insects affect corresponding parts of the host plant

(2) Affection of the tip of the bud causing it to remain short but to become large and globular This is well illustrated by *Holcaspis globulus* Fitch (Fig. 34, a, b, c.) By collecting specimens of this gall in April or early part of May it is easy to demonstrate that the gall is in reality an enlargement of the stem part of the bud. The insect evidently deposits the egg in the apical part of the incipient stem. This causes the stem to enlarge, forming a globular body, but to remain so short as to form a sessile gall on the main stem. The bud scales are at first very prominent but gradually shrivel up and are lost, leaving a naked,

globular gall At this late stage the only evidence that we have of its bud origin is its location at the node of the main stem The transition from bud to gall occurs very early before there is any differentiation of the parenchyma tissue examination of the structure of the gall fails to show any stem characters but does show the Cynipidous gall character described in Part I of this series

(3) The third type of the bud gall is illustrated in *Andricus seminator* Harris (Figs 35 a b and 36 a b) Ashmead* refers to this as a flower gall It is not difficult to demonstate that this gall is a true compound bud gall but whether it is a flower or leaf gall is not so easily determined The strongest evidence of its bud character is its location at the node of the stem and the presence of the leaf scales at its base The writer gathered and dissected a large number of galls of various ages and is confident that this is a true compound bud gall In Figure 35 a we have a short twig with three buds one of which was attacked by the insect the other two buds remained unaffected Around the base of the gall are four well defined bud scales In Figure 35 b two buds were affected one of these has been removed showing the scar where it was attached and also exposing the back side of the compound gall formed from the other bud A great many galls of various ages were dissected the younger ones showing the bud scales and the older ones showing the well defined scars by which it was easy to trace the number of buds affected Careful observations were made in hopes of finding a gall which would show whether this was a leaf or flower bud but without success However from a careful microscropic examination of a number of galls I am inclined to consider it a leaf bud in which each leaf becomes a single gall of the large cluster and in which the incipient stem remains short The microscopic examination of the single galls (Fig 36 a b) shows that each gall contains at least one (and usually only one) fibro vascular bundle which in most cases is very much atrophied and in some cases so much reduced as to be very indistinct The writer considers the fibro vascular bundle as the mid rib of the modified leaf and the cottony part of the gall as the mesophyll part of the leaf This gall does not show the four zones which are characteristic of the cynipodous galls as pronounced as other galls which we have examined but this point will be discussed in a later paper

(4) The fourth type of gall is illustrated by a cecidomyid gall (Fig 37) found upon Acer negundo in which the bases of the petioles of a number of leaves from the same bud are enlarged

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*Ashmead Wm H On the Cynipidous Galls of Florida with descriptions of new species and synonyes of the described species of North America Trans Amer Ent Soc Vol XIV pp 25 28 thus forming a bulb-like compound gall. On the inner surface of the base of each petiole is a cavity containing the larva. The stem remains short but the outer leaves are fully developed in most cases.

(5) *Pachypsylla celtidis-gemma* Riley (Fig 38) is evidently a bud gall very similar to the preceding Only advanced stages of this gall were collected, and therefore its development could not be observed. From the specimens collected it appeared that each scale and undeveloped bud formed a pocket for the insect, there being a single insect under each scale

CONCLUSIONS

Bud galls are subject to considerable variation due to the fact that they are produced by insects of different orders and that these insects attack different parts of the buds and different tissues in these parts In all cases except the fourth the demands of the insect are so great as to cause a very pronounced change in the bud In the fourth the modifications are not so pronounced as in the other four types.

PART IV STEM GALLS

Stem galls, according to my definition, include only those galls which cause a swelling of the stem and with the larva placed in or near the center, thus affecting the stelar and fibro-vascular parts of the stem This definition may not be as broad as it should be, but I hesitate to make it include other forms until I have had an opportunity to make a more careful examination of the questionable forms. The fact that such galls as H globulus (Fig. 34, a, b, c), which is frequently mentioned as a stem gall, are in reality bud galls, leads me to be doubtful of the origin of galls which have similar locations Many of the so-called stem galls may be in reality bud galls and this point can be determined only by a study of their development and structure

Some galls occur on both leaves and stem, but in these cases the gall affects only the outer layers of the cells of very young twigs and these cells at this time resemble the leaf cells in both structure and functions. *Phylloxera carya-spinosa* Shimer (Part I, Fig. 19) and *Phylloxera caryae-caulis* Fitch (referred to in Part V) are good examples of leaf galls affecting stems.

The Lepidopterous galls are usually stem galls and may be either solid or hollow and are most common on Solidago. In studying such galls it is necessary to examine first a normal stem.

The stem of Solidago (Fig. 39) shows the ordinary dicotyledonous character. The epidermal cells (e p) are firm and rather hard. Just below these cells is the parenchyma zone (p a) of closely-fitted cells and few intercellular spaces. Below the parenchyma zone are the fibro-vascular bundles (p. v. b.), which contain a large amount of woody, fibrous tissue. Inside the zone of fibro-vascular bundles and forming the axis of the stem, is the stelar (st) made up of large parenchyma cells.

In *Trypeta solidaginis* (Fig. 40) a solid globular gall on the stem of Solidago, we find the walls of the outer parenchymatous cells much thickened and numerous large intercellular spaces which are not characteristic of the unaffected stem (Fig. 39). The fibro-vascular bundles (f. v. b.) are spread out and flattened, the sclerenchyma tissue and tracheary tissue being reduced and the fibrous tissue increased in amount. The parenchyma tissue of the stelar (st) part of the gall is increased in amount and the size of the cells reduced. This tissue is undoubtedly very active and well supplied with nutrition for the larva. Throughout the tissue are tubes (tu) lined with cells smaller than the parenchyma cells, brown in color, and not affected by haematoxylin stain. These tubes are usually associated with small bundles of fibrous tissue and are probably important factors in the nutrition of the larva. They were not found in sections of normal stem of corresponding age.

In *Gelechia gallae-solidaginis* Fitch (Fig. 41) an elongated, hollow gall on Solidago, we find the parenchymatous tissue (pa) near the surface increased in amount, the cells larger and the walls thicker than in an unaffected stem, but no intercellular spaces such as are found in T. solidaginis. The fibro-vascular bundles (f. v. b.) undergo comparatively little change, becoming slightly flattened and thinner and with a reduction of the firmer fibrous tissue. The larva chamber (l. c.) of the gall is lined with a few layers of small parenchymatous cells (st) and is the stelar part of the stem. This parenchymatous tissue is udoubtedly used for food.

In *Cecidomyia rigidae* O. S. (Fig. 42) an elongated, hollow gall common on Salix discolor, usually near the tips of the twigs, we find considerable modification of the normal stem structure. From the examination of a number of specimens it is very clear that the enlargement of the stem is due to two factors: the formation of large intercellular spaces near the surface, similar to those in T. solidaginis (Fig. 40), and the formation of the larval chamber (l. c.) in the stelar part of the stem. The parenchymatous tissue lining the chamber is made up of cells very much smaller than those in an unaffected stem.

The Lepidopterous galls on the young stems of Acer negundo and Coleopterous galls on Rubus villosus were examined but no new points presented. I was unable to secure satisfactory specimens of stem galls of Cynipidae.

Although the study of stem galls was in many respects unsatisfactory, I feel justified in giving the following brief conclusions.

CONCLUSIONS.

1. Stem galls show less variations than any other group of galls, although they may be produced by insects from widely different orders. This is undoubtedly due to the fact that the various insects attack corresponding parts of the host plants. In proof of this fact, it will be noticed that all these insects deposit the egg within the tissues of the host plant and not on the surface.

2. The galls in general show an increase of parenchyma below the epidermis, either a thickening of cell walls or a development of intercellular spaces, a flattening of the fibro-vascular bundles, an increase of parenchyma tissue in stelar part of stem and a decrease in size of same.

PART V. DEVELOPMENT OF GALLS.

A very large amount of material was collected for this paper and great difficulty was experienced in getting the extremely young stages because of the fact that young specimens were difficult to recognize and identify. The material was carefully killed in either Fleming's solution or chromo-acetic, passed through the alcohols, imbedded in paraffin, sectioned on a Zimmerman microtone and stained in haematoxylin.

The galls will be considered in the same order as in Part I of this series. A consideration of the leaf structure is unnecessary since that was considered in Part I.

I. GALLS OF ACARINA.

Young galls of *Phytoptus quadripes* (Fig. 43), *P. abnormis* (Fig. 44), and *P. acericola* (Fig. 45) were studied, and all show the same developmental characters. The leaf becomes slightly pitted on one side (usually the lower) and a corresponding elevation is formed on the upper surface. This gradually enlarges until the more or less spherical gall is produced. In P. abnormis the spherical gall soon assumed an elongated form. The characteristic cell structure of the leaf is lost and the cells become very irregular in shape. The elongated character of the cells just beneath the outer epidermis appears at a later period of the development. At first the inner surface of the gall is perfectly smooth, but very soon masses of cells are formed and project into the cavity (Figs. 43 and 45). At about the same time trichomes begin to develop from the inner epidermis (Fig. 44) and project into the cavity. These trichomes grow very rapidly and almost fill the entire cavity.

In the very young galls no fibro-vascular bundles are formed, but in the older galls small bundles of fibrous tissue are numerous.

The first effect of the insect attack is undoubtedly to cause an increase in the number of cells, which is an effort on the part of the plant to heal the wound produced by the repeated puncturing of the cells by the parasite Since the parasite continues its attack upon different cells and the plant makes the repeated effort to heal the wound, we have the very active production of cells. The parasite making its attack upon one side of the leaf, causes the unequal growth resulting in a cavity The increase in size of the gall causes a different tension upon the inner and outer surfaces and results in the elongation of cells near the outer surface as described in Part I.

When the galls first appear they are single, but in a very short time others are formed just outside the first, thus forming a cluster.

In *Erineum anomalum* (Figs. 47, 48, a, b), occurring on leaves and petioles of walnut, we find a condition similar to that of the Phytoptus galls except that the parasite is on a free surface instead of in a partly closed cavity. I was able to secure a very complete series of this gall The first indication of the gall on the petiole or rib of a leaf is the increase in the amount of parenchyma tissue between the epidermis and fibro-vascular bundles. The physiological character of this tissue is also changed to some degree, since the cells are not so easily stained with haematoxylin, have rather thick walls, and contain a considerable quantity of tannin. The epidermal cells now begin to form trichomes (Fig 47). The parenchyma tissue and trichomes both increase in quantity, the walls of the cells become thinner (Fig. 48, a, b), and the deeper parenchyma tissue gradually loses its tannin, while the outer cells retain it in great quantities

These galls always occur over a fibro-vascular bundle and are apparently closely associated with them These bundles become modified to some extent.

The origin and development of these galls is the same as in the Phytoptus galls except that the parasite works upon the exposed surface instead of in a cavity The fact that one produces a cavity lined with trichomes while the other produces a protuberance covered with trichomes, is probably due to the fact that the latter is so closely associated with the fibro-vascular bundle which prevents the curvature but causes the rapidly-formed cells to swell outward into a protuberance

2. GALLS OF THE APHIDIDAE.

In the Aphididae galls we have a condition very similar to that just described for the Acarina galls except that the shape of the galls are far more definite and they show a higher degree of development. Trichomes are not so numerous and masses of cells projecting into the larval chamber as described for Phytoptus galls are very rare. In the youngest galls the cell structure of the leaf is modified, resulting in the formation of a large number of small, irregular cells, the same as in the Acarina galls. As the galls grow older the cells near the outer epidermis become elongated as in the Phytoptus galls.

In *Pemphigus ulmifusus* (Walsh) Oestland (Fig 49, a, b) on U. Americana, we have the gall originating first as a fold in the leaf which becomes developed into a conical structure The structure of the gall shows that the characteristic structure of the leaf is at first modified into a large number of small, irregular-shaped cells (Fig 49, b) The tendency for the cells near the outer surface to elongate parallel to the surface begins with the further development of the gall In the very young galls the tannin is in very small quantities, but increases as the gall grows older

In *Colopha ulmicola* Fitch (Fig. 50, a, b) we have a condition almost identical with P. ulmi-fusus The gall first appears as a slight fold in the leaf and later develops into the characteristic cockscomb gall The cell structure is the same as in P ulmifusus

In *Phylloxera carya-fallax* Riley (Figs 51, 52) on H ovata, I secured the youngest galls possible to detect and identify. These galls showed a slight projection from both surfaces of the leaf, but at first the gall was not so conical as at a later period of its development However, the youngest galls showed the characteristic structure described in Part I of this series The first effect of the parasite attack appears to be the formation of a large number of irregular cells The arrangement of these cells is the same in the young gall as in the more mature, but the fibro-vascular bundles of the older specimens were not observed in the young galls.

I was not so successful in securing young specimens of P c -globuli Walsh (Fig 53), but, so far as I was able to observe, the line of development coincided with P c -fallax However, the upper wall of the gall is at first very thin and grows in thickness as the gall approaches maturity

Phylloxera carya-caulis Fitch of Hickory ovata was studied very carefully from a very complete series of specimens The material, especially the younger galls, did not cut well, and so was not satisfactory for drawings. However, the development and structure were of the typical Phylloxera type corresponding very closely with that just described for P c -fallax The only marked peculiarity was the close association with fibro-vascular bundles, the galls always occurring on very young green twigs, on mid-rib or on prominent veins of the leaf.

Pemphigus populi-transversus Riley (Figs. 55, a, b, and 56, a, b) and *P. p.-caulis* Fitch (Figs 57, a, b, c, and 58, a, b, c) of the Populus are galls growing on the petiole; the former at some point between the blade and stem, the latter at the base of the leaf. In both cases the attack is made from the outside, the same as in other Aphididae galls and in the Acarina galls. A careful study of an excellent series of both galls shows a cell structure and development very similar to other Aphididae galls; i. e., a large number of small, irregular cells. In P. p.-transversus (Fig. 55, a, b) the gall originates as a swelling on the petiole and within this swelling is a large cavity opening to the outside through a slit. In the P. p.-caulis the same condition is true but the attack of the insect causes a one-sided growth, resulting in the petiole being twisted at right angles to the blade (Figs. 57, a, b, c, and 58, a, b, c).

A careful examination of the cell structure of P. p.-transversus (Fig. 56, a, b) and a comparison with the unaffected petiole (Fig 54, a, b) indicated a very rapid growth, resulting in the very large number of small, irregular cells. The character of the young and of the mature gall was practically the same, and not different, as in the more highly developed galls of other orders. The fibro-vascular bundles were very slightly affected.

P. p.-caulis showed the same cell structure and development, and, judging from these points alone, one would be unable to separate these two galls

3. GALLS OF PSYLLIDAE.

In *Pachypsylla celtidis-mamma* Riley (Figs 59 and 60, a, b, c) of the Celtis occidentalis the youngest galls did not show a cavity, but showed a modification of the leaf by which there is formed a large number of small, irregular cells which can be readily separated into two zones, the upper made up of small, and the lower of somewhat larger cells (Fig 59) I was unable to secure specimens intermediate between this stage and a later stage, showing the true form of the gall (Fig 60, a, b, c) The youngest galls, showing the true form, exhibited four well-defined zones (1) epidermis, (2) zone of large, irregular-shaped cells, (3) zone of elongated cells, (4) zone of irregular-shaped cells next to the larval cavity. Adjacent to zone (3), but derived from zones (2) and (4), are cells which even in very young galls show schlerenchyma characteristics As the gall approaches maturity this tissue increases until in the mature gall it may be found in great abundance. This gall is undoubtedly the most highly developed of any of the Hemiptera galls which I have studied

4. GALLS OF CECIDOMYIA

Although I have a large number of Cecidomyia leaf galls, I have succeeded in getting a series of only two species. Since the Cecidomyia show by far the greatest variation in structural characters and the smallest number of typical group characters, two species are not sufficient to draw a very definite conclusion.

In *Cecidomyia gleditsiae* O. S. (Fig. 61, a, b) the two halves of the leaflet never have an opportunity to unfold, but there is a growth of cells allowing the leaflet to enlarge and form the larval chamber between the two halves. The cells are at first normal, but gradually lengthen in an axis at right angles to the mid-rib. This can be readily observed by comparing the section of the very young gall (Fig. 61, a, b) with the section of the mature gall (Part I, Fig. 22).

In *Cecidomyia verrucola* O. S. (Figs. 62 and 63) the youngest showed a condition in which the mesophyll part of the leaf was reduced or entirely removed by the larva. The upper epidermis and palisade cells, the lower epidermis and cells next to it, form the upper and lower walls of the larval chamber while the intermediate mesophyll is removed. The inner layers of cells, i. e., the cells next to the larval chamber, now grow and divide very rapidly, gradually filling almost the entire cavity and reducing the size of the chamber (Part I, Fig 24). At the same time the gall is increasing rapidly in size.

5 GALLS OF THE CYNIPIDAE.

Although a large amount of material was collected, only three species were sufficiently complete to enable a satisfactory study. However, several mature galls of species not described in Part I of this series were examined, and all agreed with the statements made concerning the general structural character of this group of galls

Callirhytis papillatus O. S. (Fig 64) was especially difficult to collect because of its very small size and close resemblance in external appearance to other small Cynipidous galls. Examination of young Cynipidous forms, which I am reasonably certain belong to this species, show all the zones in contact (Fig. 64). As the gall develops the protective zones and parenchyma zones separate but remain connected by elongated parenchymatous cells (Part I, Fig 30)

Dryophanta palustria O S. (Fig. 65, a, b) appears as the leaves unfold from the bud. The youngest galls collected were not over two millimeters in diameter but showed the four zones well developed, with the second and third zones in contact, thus verifying the views expressed in Part I. The cells of the innermost, or nutritive, zone were large and very granular. Evidently this zone was almost completely reduced by the larva in the specimen from which Fig. 29 of Part I was drawn In the next, or protective, zone the cell walls were very thick. In the parenchyma zone the innermost cells were small and numerous and the walls were thin, and in both cases the long axis of the cells were at right angles to the surface of the gall As the gall grows older the intercellular spaces may become prominent among the cells of the parenchyma zone (Fig 65, b). Careful examination of a large number of specimens gave conclusive proof that the separation occurs between the protective and parenchyma zones, thus leaving the two inner zones as a small sphere rolling free within the larger sphere which is formed by the two outer zones.

In *Diastrophus similis* Basset (Figs. 66, a, b; 67, 68, a, b, c, d; 69) we have a Cynipidous gall occurring on Nepeta glechoma I secured a very complete series of this gall and made a very careful study of its development In the youngest gall (Fig 66, a, b) we have the cell character of the leaf transformed into a mass of small, irregular cells which can be readily divided into two zones, the outer of which has the larger cells At this time the cells are very compact, but as the gall grows older intercellular spaces are developed, the entire structure becomes loose and spongy and the cells become larger.

As the galls grow older a well-defined zone of flattened cells is developed in the parenchyma near the epidermis, and fibro-vascular bundles (f v b) are developed at right angles to the surface (Fig 67) Up to this time the cells are small, irregular and compact. The epidermis (ep) and parenchyma (pa) zones are well defined, but the distinction between protective and nutritive zones cannot be made

As the gall grows older a cleavage plane is formed in the parenchyma just inside the zone of flattened cells (Fig 68, a). A careful examination of the parts thus cut off and surrounding the larval chamber (l c) shows two well-defined zones which correspond to the nutritive and protective zones described in Part I At this time there is no marked difference in the amount of food supply of the two zones In the outer part formed by this cleavage plane we have the parenchyma (pa) and epidermal (ep) zones (Fig 68, c) Connecting the parenchyma and protective zones we find fibro-vascular bundles (f v b) surrounded by parenchyma cells (Fig 68, d). The character of these connecting strands is very similar to that described for H. centricola (Part I, Fig 27) and A manis (Part I, Fig 28), but contains more parenchyma tissue than either. However, the parenchyma cells are not so elongated as in C. papillatus (Part I, Fig 30) As the gall grows older the cells of the protective zone become clear and the cell walls of the nutritive zone gradually thicken (Fig. 69), many undergoing complete degeneration, while others assume the character of the sclerenchyma

CONCLUSIONS

1. All conclusions given in Part I are emphasized by the study of the development of the galls

2. In the formation of all leaf galls except the Cecidomyia galls, the normal cell structure of the leaf is first modified by the formation of a large number of small, compact, irregular-shaped cells. In the galls of Acarina and Aphididae this is followed by

a development of trichomes, especially the former In all galls the mesophyll is subject to the greatest modification Many small fibro vascular bundles are formed in this modified mesophyll

3. The Acarin may be considered the lowest group of galls, the Aphidid the next higher, the Cecidomyia galls the next higher, and the Cynipidous galls the highest However, many of the Cecidomyia galls are lower than the Aphidid galls.

4 The galls of Acarina and Aphididae show the greatest resemblance In these cases the method of attack is very similar and is first directed against the epidermal or adjacent layer of cells.

5. In some of the Cecidomyia galls (e g C. verrucola) the larva appears to make its entrance into the mesophyll before there is any pronounced modification of the cell structure However, the Cecidomyia galls are too varied and the study too incomplete to make a positive conclusion

6 Both Adler and Fockeu consider that after the first stages of formation, the gall becomes an independent organism growing upon the host plant This is probably true in the highly developed galls of Aphididae, Cecidomyia and Cynipidae, but the writer is very doubtful if this is true of the less complex galls of Acarina, Aphididae and Cecidomyia

This work was pursued during the year 1902-03, in the Biological Laboratory of DePauw University, but was under the supervision of Professor Herbert Osborn, of the Ohio State University, to whom I am indebted for many valuable suggestions. I am also indebted to two of my former students, Miss S Emma Hickman and Miss Margaretta S Nutt, for aid in preparing slides and making drawings Drawings made by these two ladies are marked with their initials I also wish to express my thanks to my many friends who have called my attention to, or have collected material for, these investigations

LITERATURE

New literature will not be cited at this time, but a more complete list will be given in connection with later papers upon this subject.

EXPLANATION OF PLATES.

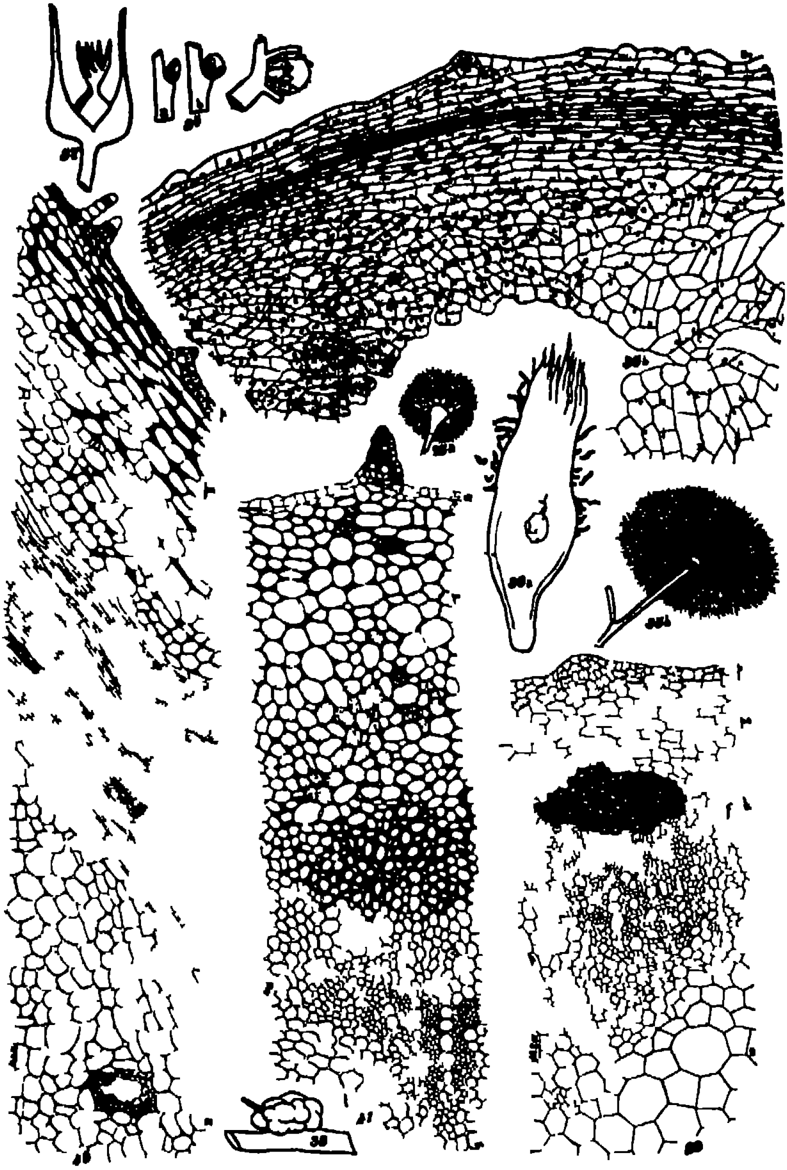
In making the drawings a Bausch & Lomb microscope, with No 2 ocular and ⅙ objective, and a B & L camera lucida were used. The drawings are, therefore, larger than those used in Parts I and II, and the reduction not so great. The diagrams are not made upon a definite scale Drawings 34, a, b, c, 35, a, b; 37, 38, 55, a, b, 57, a, b, c, and 58, a, b, c, were made from nature, and are very little smaller than the original. The numbering of the drawings is continuous with Parts I and II.

ABBREVIATIONS.

ep —epidermal zone
pa —parenchyma zone
pr —protective zone.
nu —nutritive zone.
f v b —fibro-vascular bundles

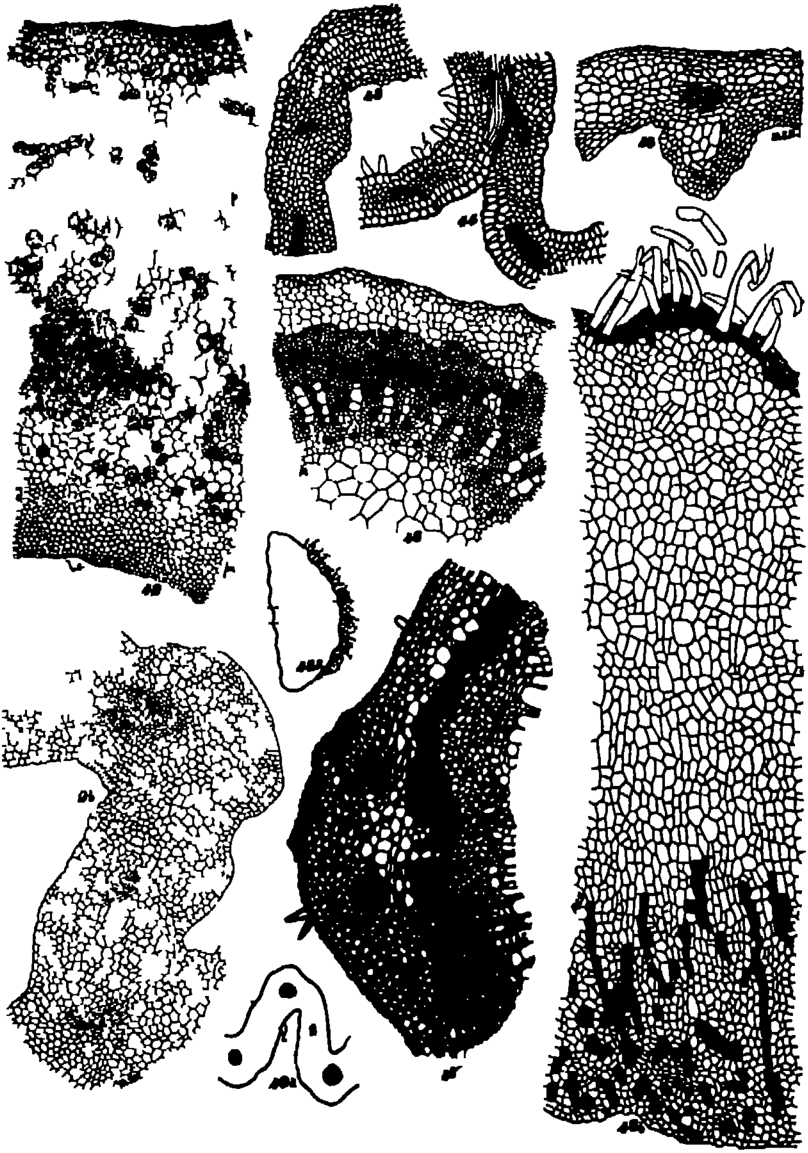
34, a	Bud of Hicoria ovata
34 b, c	Holcaspis globulus on H ovata
35, a	Andricus seminator gall and two buds on Q alba
35, b	Andricus seminator gall and bud scar on Q alba
36, a, b	Section of Andricus seminator gall on Q alba
37	Cecidomyia gall on A negundo
38	Pachsylla c-gemma on C occidentalis.
39	Cross section of stem of Solidago
40	Trypeta solidaginis on Solidago
41	Gelechia galliae solidaginis on Solidago
42	Cecidomyia rigidae on Salix
43	Phytoptus quadripes on A saccharinum
44	" abnormis on T Americanum (Two larval chambers)
45	" acericola on A saccharinum
46	Petiole of Juglans nigra (Cross section)
47	Erineum anomalum on J nigra (Young gall)
48, a, b	Erineum anomalum on J nigra (Mature gall)
49, a, b.	Pemphigus ulmi-fusus on U Americana
50, a, b	Colopha Ulmicola on U Americana
51	Phylloxera carya-fallax on H ovata
52	" " " "
53	" carya-globuli on H ovata
54, a, b	Cross section of petiole of Populus monilifera
55, a	Pemphigus populi-transversus on petiole of P monilifera. (Young gall)
55, b	Same in section
56, a	P p-transversus Part of gall near opening into larval chamber
56, b	P p-transversus Section back of chamber and showing one fibro-vascular bundle of the petiole
57, a	P p-caulis Young gall, ventral surface
57, b	" Young gall, dorsal surface
57, c	" Young gall, open
58, a	" Ventral surface
58, b	" Dorsal surface.
58, c	" Open
59	Pachypsylla celtidis-mamma on C occidentalis (Young gall)
60, a	P c-mamma Diagram
60, b	" Section of dorsal part (2 and 3)
60, c	" Section of ventral part (3 and 4)
61, a, b	Cecidomyia gleditsiae on G triacanthos
62	" verrucola on T Americana (Young gall)
63	" " " "
64	Callirhytis papillatus on Q palustris.
65, a, b	Dryophanta palustris on Q palustris
66, a, b	Diastrophus cuminis on N glechoma.
67	" " " "
68, a	" " Diagram
68, b	" " Nutritive and protective zones
68, c	" " Epidermal and parenchyma zones
68, d	" " Strand connecting protective and parenchyma zones.
69	" " Nutritive zone in gall almost mature

Ohio Naturalist *Plate 13*

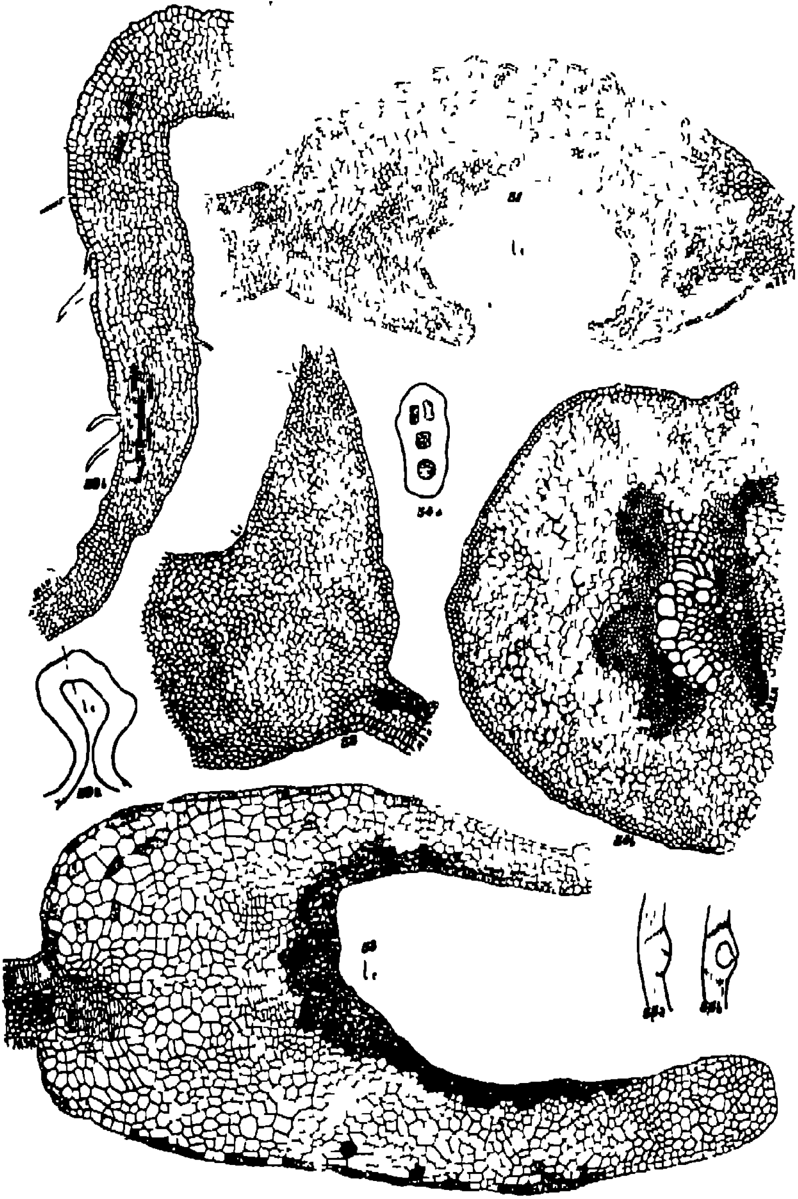


Cook on Galls and Insects Producing Them

OHIO NATURALIST *Plate 4*

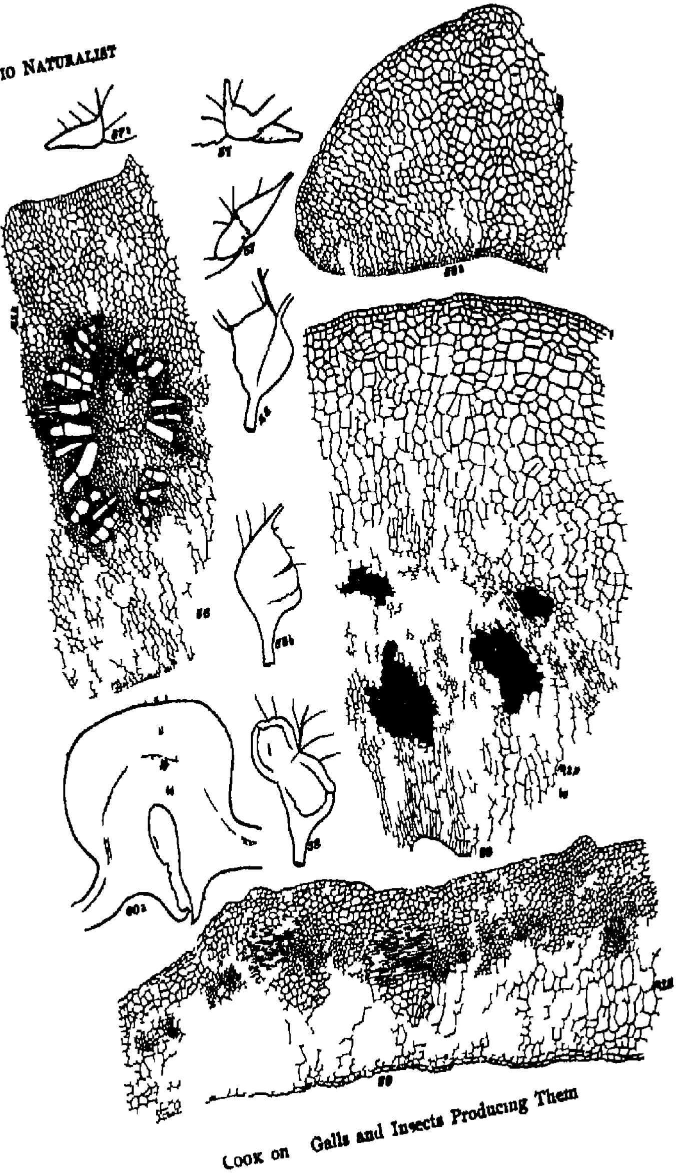


COOK on Galls and Insects Producing Them

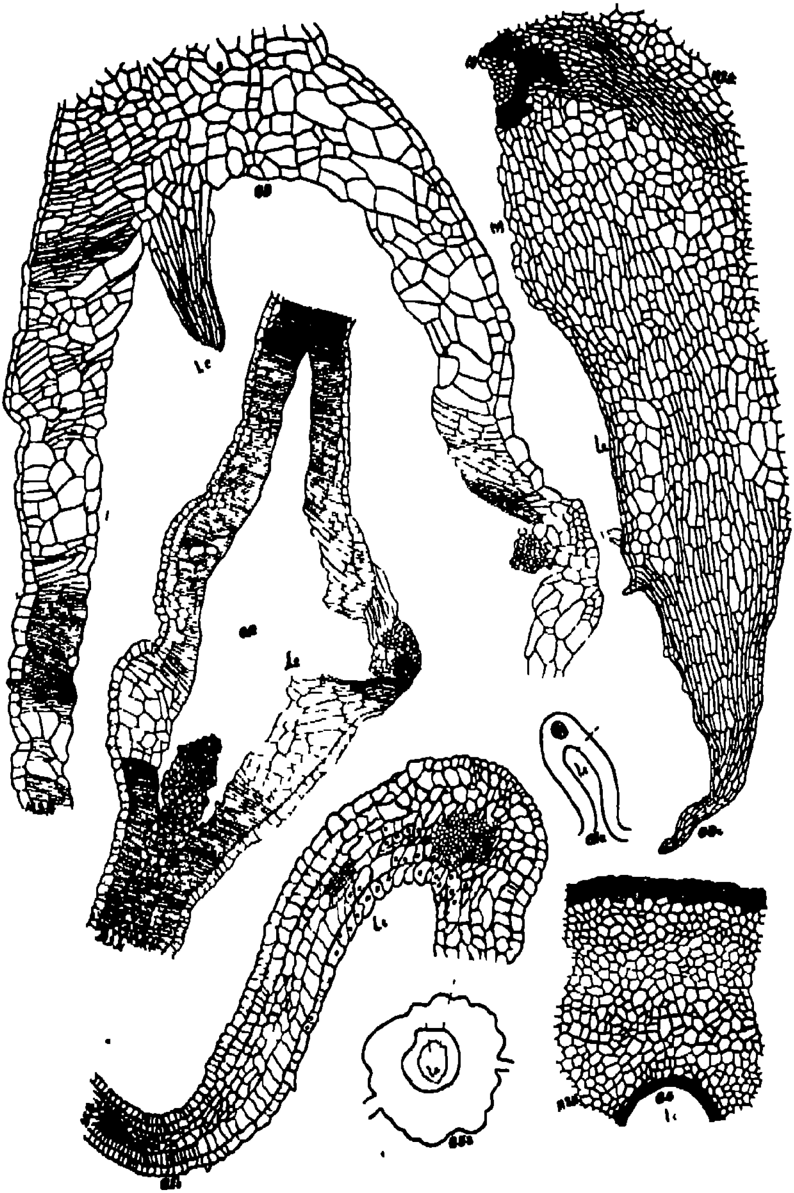


COOK on "Galls and Insects Producing Them."

Plate 16

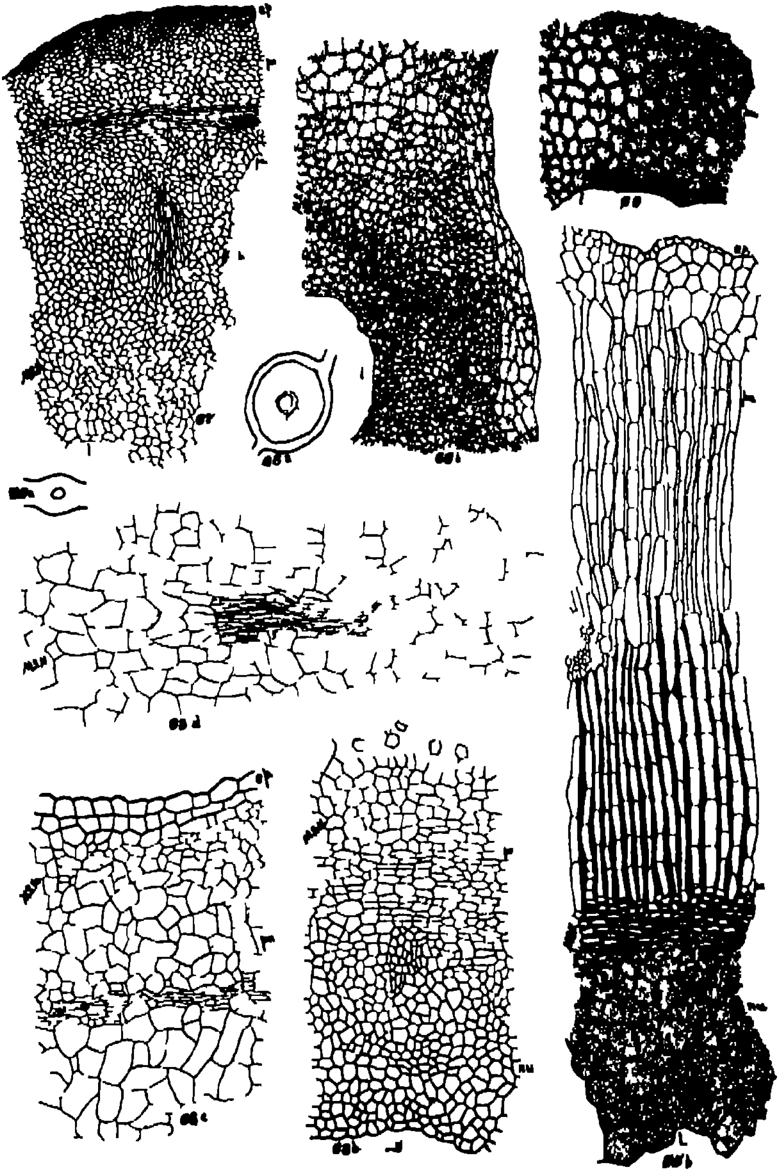


Cook on Galls and Insects Producing Them



COOK on "Galls and Insects Producing Them"

OHIO NATURALIST *Plate 18*



COOK on 'Galls and Insects Producing Them.

MEETING OF THE WHEATON CLUB.

The Club met in Biological Hall, Monday evening, April the twentieth. After the reading of the minutes there was a short business session in which, among other matters, the Club resolved to make efforts toward the better protection of birds in the University grounds. After the business session the Club spent most of the evening in a general discussion of the causes, routes and general phenomena of bird migration Prof Smith opened the discussion by a review of the articles published several years ago by Prof W W Cooke upon "Bird Migrations in the Mississippi Valley" The investigations upon which this was based, could not, by reason of the physical features of the region studied, afford much light on the question of the existence or non-existence of particular bird routes At this point Prof. Smith took occasion to state the conflicting theories upon this subject which are held by European ornithologists, some holding that birds migrate along special paths and others that they pass in a broad mare The point covered to a fuller degree in the article reviewed was as to the effects of mind and temperature particularly the latter, upon migration flights and the author of the article seemed to consider the effect of temperature the more important An article in the *American Naturalist* for September, 1902, upon "Bird Migrations" by Dr C C Trowbridge was then briefly reviewed by Mr Derby This article which based its conclusions upon the observations of hawk migrations upheld the influence of wind in migration as opposed to temperature Mr Mead then presented a paper upon "The Great Auk" He first described the distribution of the bird and commented upon the fact that it occupied formally in the North Polar regions the position held by the Penguin in the South He next took up the appearance and habits of the birds, speaking of its awkward movements, habit of flocking in great numbers, the fact that only a single egg was laid and other interesting details He then described graphically the former abundance of the Auks and their wholesale destruction for the sake of the eggs, flesh and feathers by the sailors The last live birds found were captured in 1844 In closing mention was made of the specimens in existence and of the value assigned to them Prof Hine called the attention of the Club to two records made some years ago, of birds very rare in the state, the Red-cockaded Woodpecker and the Red-tailed Black Hawk, both taken in this region In the line of personal observations Mr Dawson reported several early records, among which were Hermit Thrush, March 15, Barn Swallows, April 4, and Bobolink and Chimney Swift, April 12

WALTER J DERBY, *Secretary*

MEETING OF THE BIOLOGICAL CLUB.

ORTON HALL, March 2, 1903

Mr Quiroga gave a paper on his native country, Argentina. It served to call the attention of those who heard it, to the fact that Argentina is not to be compared with such Latin-American countries as Venezuela and the Central American Republics. The facts given and the pictures exhibited showed very plainly that in prosperity and commercial advancement the country is on a level with the United States. The paper took up exhaustively the geographical relations, topography, geology, physical geography, climate, agriculture, transportation, industries and education Whenever practicable tables were given showing comparisons with the United States In some respects, for example in the animal industries, the comparison was decidedly in favor of Argentina.

Prof Osborn stated that as he read the census reports he made out a better case for the United States than did Mr Quiroga.

The second paper was by Prof Schaffner on "Mendel's Law of Heredity He gave a short history of Mendel's work and explained the meaning of the law In order to get the characters of only one of the parents in the offspring, the sex cells from which it comes must have been pure. If we believe that in the reduction division of the sex cells the division is longitudinal, there is no possibility of an unequal distribution of hereditary tendencies. But in a transverse division, segregation of characters is possible In cytology there is nothing to indicate the percentage of hybrids being as Mendel found it He thought that the ratio must be dependent rather on some balance of external conditions. He also questioned whether the statistical method was entirely reliable

ROBERT F GRIGGS, *Secretary*

Notice to Subscribers.

Beginning with the first issue of Volume IV the price of THE OHIO NATURALIST will be one dollar per volume instead of fifty cents as heretofore. At the present price the editors can not publish nearly all of the desirable material offered At the increased subscription the management hope not only to publish more papers but to be able to publish longer papers and thus make the NATURALIST of more value to those interested in special subjects The new price applies to subscribers not members of the Biological Club of the Ohio State University.

F. L. LANDACRE.

The Ohio Naturalist,

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THE EMBRYOLOGY OF VALLISNERIA SPIRALIS.*

HARRIET G. BURR.

The material for this study was gathered in Sandusky Bay in July and August, 1902. It was killed in chromic acetic acid, preserved in 70 per cent alcohol, imbedded in paraffin, cut on a Minot rotary microtome and stained in anilin safranin and gentian violet and also in Heidenhain's iron alum haematoxylin. For the development of the embryo sac the former was the best, and the latter for the staminate flowers. For the embryo either stain gave satisfactory results.

The sections were cut 8-12 microns thick, the staminate flowers transversely and the carpels longitudinally. The older ovules were removed from the ovulary and imbedded separately. This was necessary on account of the mucilaginous material which was contained in the carpels.

The work was carried on at Ohio State University under the direction of Prof. J. H. Schaffner, to whom I am greatly indebted for assistance and suggestions.

The carpellate flowers are borne on a long scape with a tubular one-flowered spathe. The perianth has a linear tube adnate to the one-celled ovulary. There are three small petals and three stigmas which are short and broad. The ovules are numerous and orthotropous, borne one the ovulary wall. The staminate flowers are numerous, nearly sessile on a conic receptacle enclosed in a spathe which is borne on a short scape. The perianth is three-parted, the petals being very small. The androecium (Fig. 9) is a two-parted structure which may be regarded as two stamens united at the base or a single stamen as described by Engler and Prantl. If the former view be held the anthers must be regarded as being bilocular The related plants, of the Alismaceae and Naiadaceae, as well as the Vallisneriaceae, are described by Britton and Brown as having two celled anthers

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* Contributions from the Botanical Laboratory of Ohio State University, XII.

Fig 9 shows the microsporocytes in the pollen sacs Before the pollen is shed the grains are three-celled, having a large tube nucleus and two smaller male cells (Fig 10)

The young ovule has two integuments, the inner one is barely beginning to appear when the archesporial cell is organized (Fig. 1) The archesporial cell is hypodermal in origin From this a tapetal cell is cut off and this divides into two (Figs 2 and 3) The megasporocyte enlarges and four megaspores are finally produced by two transverse divisions, although in some cases some of the walls may be oblique (Figs 4 and 5) The functional megaspore, which is the lowest, divides into two cells, forming the two celled embryo-sac in the usual way (Fig 6), one cell passes to the upper and the other to the lower end of the sac and by successive divisions the typical eight-celled embryo-sac is formed (Fig. 7) The polar nuclei are rather large and they conjugate in about the middle of the sac A large number of these conjugations was observed, but there was no trace of a triple conjugation of polar nuclei and a male cell The synergidae lie side by side, extending across the upper end of the sac, and beneath them is the oosphere The antipodals have the same relative position in the lower end that the egg-apparatus has in the upper end

At the first division of the definitive nucleus two cells are formed with a transverse wall across the sac between them The upper one of these by further division forms a small amount of endosperm tissue The lower one develops into a large vesicular cell with a large nucleus (Fig 8) This same structure with the partition wall was found by Schaffner in *Sagittaria*, by Cook in *Castalia* and *Nymphaea*, and by Murbeck in *Ruppia* It has also been found in other groups Contrary to the case in *Sagittaria*, no direct division of this nuclues was observed At this stage the antipodals are in a pocket at the base of the sac, where they persist for a long time

The first division of the oospore is transverse The lower cell elongates and divides transversely also, forming the first three cells of the proembryo (Fig 11). The upper one of these does not divide but forms a very large suspensor cell as is usual in the Helobiae. The next division is in the middle cell and is also transverse There is now a tier of four cells. The lowest one of the tier divides longitudinally (Fig. 12), and following this division there is a transverse division in the cell next to the large suspensor cell-followed by another longitudinal division in the lowest tier and one in the tier above (Fig. 13). At this stage the pro-embryo is composed of nine cells arranged in five tiers. Following this, the four basal cells (*c*) divide by transverse walls, thus forming an octant, the next tier (*b*) divides by longitudinal walls, forming a quadrant, the next tier (*d*) divides into two cells by a longitudenal wall, while at the same time there is a transverse division in the tier (*e*) below the suspensor cell. These divisions, therefore, give rise to a seventeen-celled embryo (Fig. 14.)

The eight cells from the basal tier give rise to the single terminal cotyledon, the lateral plumule develops in the next tier while the radicle is developed from tiers, d, e, f, etc. (Fig. 16). Following this seventeen-celled stage the number of transverse divisions is continued in the cell below the large suspensor until there are about nine or ten original tiers, the embryo being organized from the six or seven terminal ones, and the rest serving as suspensor cells. The dermatogen begins to be cut off in the cells of the incipient cotyledon and continues to develop toward the root-tip (Fig. 15). The original tiers of cells begin to divide by transverse and longitudinal walls and this also appears first in the cotyledon. The development of the embryo follows quite closely that of *Sagittaria*. It remains orthotropous and when nearly mature shows the usual four regions, cotyledon, plumule, radicle and root-cap (Fig. 17.)

SUMMARY

1. The archesporial cell is single and hypodermal in origin.
2. From the archesporial cell, a tapetal cell is cut off, which divides into two.
3. The megasporocyte produces four megaspores, sometimes the dividing walls are oblique.
4. The pollen grain has three cells before the pollen is shed.
5. The embryo-sac is normal in development.
6. There is a large definitive nucleus, by the first division of which a lower vesicular nucleus is formed, cut off by a transverse wall from the upper nucleus which forms a small amount of endosperm tissue.
7. The embryo develops as in *Sagittaria*, with terminal cotyledon and lateral plumule, but remains orthotropous.

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EXPLANATION OF FIGURES.

For the drawings, a Leitz stand and a Bausch and Lomb camera lucida were used For Figs 7 and 16, a No 2 Leitz ocular and No 7 Leitz objective were used, for Fig 9, a No 8 Leitz ocular and No 3 Leitz objective, for Fig 17, a No 2 Leitz ocular and 1/6 Bauch and Lomb objective, for the others a No 6 Zeiss ocular and a No 7 Leitz objective were used The magnifications given are those of the original drawings, which in the plate are reduced to ½ of their diameters

Fig 1 Archesporial cell x 950.

Fig 2 Sporocyte and tapetal cell x 950

Fig 3. Megasporocyte and two tapetal cells x 950

Fig 4 Three megaspores and two tapetal cells x 950

Fig 5 Four megaspores and two tapetal cells x 950

Fig 6 Two-celled embryo-sac with remains of megaspores x 950

Fig 7 Eight-celled embryo sac showing the egg apparatus, conjugation of polar nuclei, and antepodals x 630

Fig 8 Large lower endosperm nucleus and antipodals x 950

Fig 9 Staminate flowers showing pollen-sacs and microsporocytes x 230

Fig 10 Pollen grains x 950.

Fig 11. Three-celled embryo and persistent synergid x 950

Fig. 12 Five-celled embryo x 950

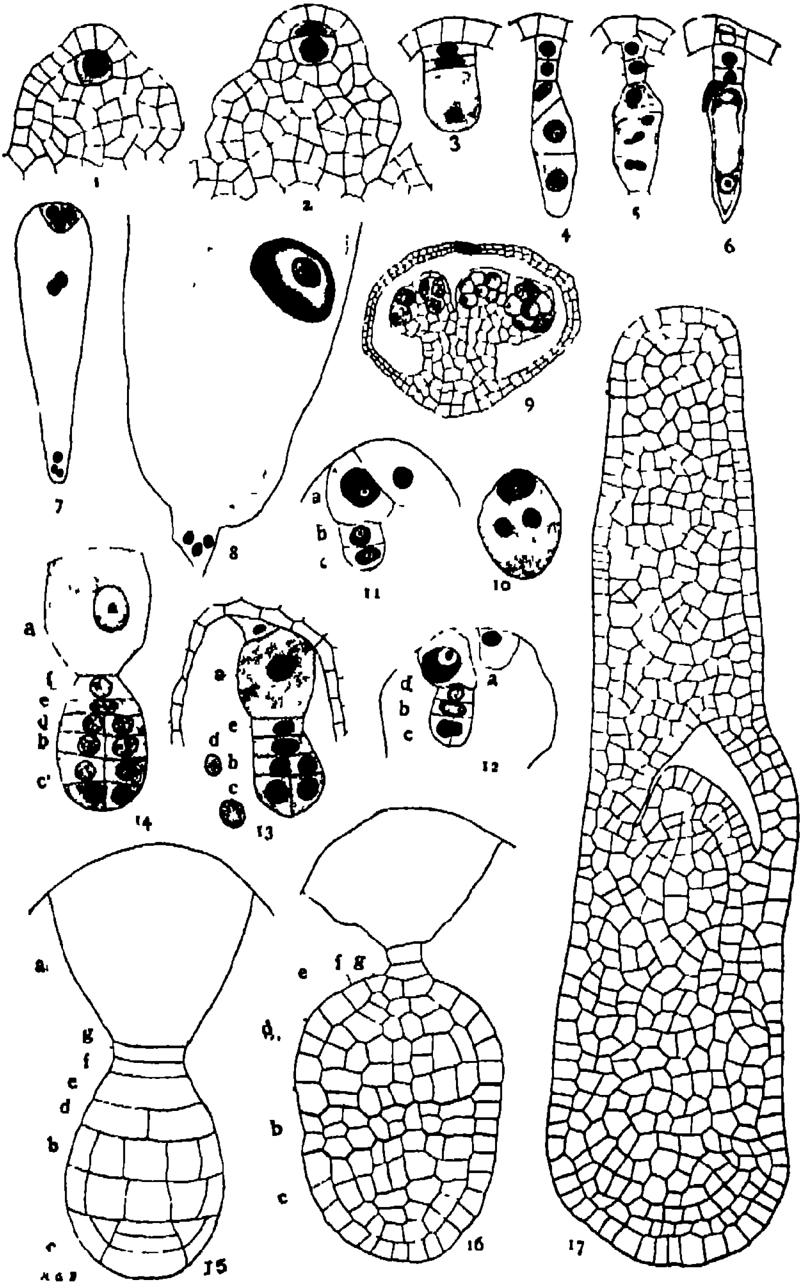
Fig. 13 Nine-celled embryo x 950

Fig 14 Seventeen-celled embryo x 950

Fig 15 Older embryo showing dermatogen x 950

Fig 16 Embryo showing origin of cotyledon (*c*), plumule (*v*), radicle (*d, e, f*) x 630

Fig 17. Nearly mature embryo showing growing point, cotyledon and radicle x 450



BURR on "The Embryology of Vallisneria spiralis"

OBSERVATIONS ON HYMENOPTEROUS PARASITES OF CERTAIN FULGORIDÆ.*

OTTO H. SWEZEY

In connection with life history studies of Fulgoridæ, the following species were reared from nymphs of Ormenis septentrionalis Spin., and Liburnia lutulenta Van D The first two as primary parasites, and the third as a secondary parasite on Ormenis septentrionalis, the fourth and fifth as primary parasites on Liburnia lutulenta

For the accurate identification of the first three species, I am indebted to Dr. William H Ashmead, Assistant Curator, Department of Insects, U S. National Museum, Washington, D C. The third species mentioned, proved to be a new species, and was given the name below

I DRYINUS ORMENIDIS ASHM.

Entomological News, XIV, p 192, 1903

In August, 1902, while collecting the larvæ and nymphs of Ormenis septentrionalis Spin (OHIO NATURALIST, Jan. 1903, p 355) some specimens were found to be infested with parasitic larvæ, which on being reared, proved to be Dryinus ormenidis Ashm

The larva lives in a "felt-like sack protruding from a spiracle" (Ashmead) at the base of the abdomen of its host, and as the latter matures, the parasite is partially covered by the wing pads (Plate 20, Fig 1) The full grown larva is 4-5 m m in length, is footless, and has rudimentary mandibulate mouth parts (Plate 20, Fig. 4) It finally causes the death of the host; then it escapes from its sack, by the latter splitting very neatly in half, and it forms a cocoon beneath the remains of the host, on the surface of the leaf upon which the host has been feeding (Plate 20, Fig 3) A cocoon was made in this manner, by a specimen in a breeding cage, Aug 5

The cocoon is oval or oblong-oval, 7 mm x 5mm , it is very white and semi-transparent, and of a low convex form, having the central portion which is occupied by the insect, a little more elevated (Plate 20, Fig 2). This figure is of a cocoon, enlarged, showing the flat expanded portion, and the central part surmounted by the remains of the host, on the right side of which is shown the sack in which the parasite lived

From August 5 to August 15, quite a number of leaves, having cocoons of this parasite, were collected from climbing bittersweet, dogwood, and other shrubbery, upon which nymphs of O. septentrionalis had been feeding. There were sometimes two and even three cocoons upon the same leaf (Plate 20, Fig. 3), and they usually were situated in the position that had been occupied by the host while living, as shown by the presence of the white waxy excretion with which the host surrounds itself on the leaf. The cocoon is very well hidden by this excretion, plus the remains of the host. It was evident that the O. septentrionalis nymphs were quite extensively parasitized.

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*Contributions from the Department of Zoology and Entomology, Ohio State University, No 13

Feb. 18, 1903—Examination of the above mentioned cocoons, (they having been kept in the laboratory during the winter), revealed six containing mature insects, all females (Plate 20, Fig. 6), one containing a pupa (Plate 20, Fig. 5), and in two cocoons they were still in the larval stage (Plate 20, Fig. 4). From this, inference is made that when remaining in natural situation among the fallen leaves during the winter, the larvæ wait till the following spring before transforming to pupæ, and that the adults would escape from the coçoons in the latter part of spring, or early summer.

All six adults and the one pupa were females. The adults were quite active when liberated from the cocoons, and it is probable that they would have soon liberated themselves. It was interesting to watch them rub their legs together, and rub them upon various parts of the body, to remove any fragments of exuvia or dust particles that might be present. It was particularly interesting to see the way they would clean the antennæ by drawing them through the antennal cleaners or combs situated on the fore legs (Plate 20, Fig. 7*a*). This structure consists of a curved row of closely set bristles, on the inner edge, at base of first segment of the tarsus. There is a large curved spine near the distal end of the tibia (Plate 20, Fig. 7*b*). When the leg is bent at this joint (Plate 20, Fig. 8), this spine is brought into opposition with the antennal comb in such manner as to hold the antenna against the comb whilst being drawn through. By moistening the antennæ, the insect was made to repeat this performance several times.

II. LABEO TYPHLOCYBÆ ASHM.

Bull. 45, U. S. National Museum, p. 89, 1893.

In examining the same lot of cocoons from which D. Ormenidis was obtained, several specimens of this form were found five adults, and one pupa; all males (Plate 21, Figs. 1, 2).

The cocoons from which these were taken were slightly smaller than the others. Otherwise they were similar, and the larvæ, also, it may be inferred, must have had similar habits; living in the same manner on the same species of host, and at the same time, and forming the same kind of a cocoon.

This lot of cocoons were supposedly all of the same species. That they were of different species was not known, until, on being opened, the two different species were found. Under the circumstances, the suggestion is inevitable that these must be male and female of one and the same species The genus Labeo has heretofore been known only in the male sex, Ashmead being of the opinion that it represents the males of the genus Gonatopus Gonatopus has wingless females, and only the females are known. Now, the difference in size and structure between Labeo and Dryinus are less than those between Labeo and Gonatopus.

Furthermore, if these specimens taken from the same lot of cocoons were of two distinct species, it seems strange that males and females should have occurred in about equal numbers (6 and 8 respectively), and that the males should all be of one species, while the females were all of the other. The evidence being, then, that these are one species, and since typhlocybæ has priority, the synonomy will stand :—

Dryinus typhlocybæ (Ashm).

Labeo typhlocybæ Ashm , Bul 45, U S Nat Mus , p 89, 1893
Dryinus ormenidis Ashm , Ent News, XIV, p 192, 1903

III CHEILONEURUS SWEZEYI ASHM.

Family—Encyrtidæ
Sub-family—Encyrtinæ

Entomological News, XIV, p. 193, 1903

February 18, 1903, fourteen adults (Plate 21, Figs. 3, 4) of this chalcid-fly were found in the box containing the lot of leaves having the Dryinus ormenidis cocoons, previously mentioned in this article. Not knowing their source, it was supposed that they came from the Dryinus cocoons Examination disclosed three Dryinus cocoons which were open, some insect or insects having escaped from them. No other insects being present, it was inferred that the Chalcids came from these three cocoons.

In opening cocoons and liberating adults of Dryinus and Labeo, as previously mentioned, one cocoon was found containing four pupæ (Plate 21, Figs. 5, 6), which in size and general structure, and particularly in shape of antennæ and the presence of tibial spines and spurs, identified them as the pupæ of the adult chalcids found in the same box. These chalcid pupæ were not enclosed in cocoons of their own. Another Dryinus cocoon contained five larvæ, which are probably Cheiloneurus larvæ.

This is rather insufficient data upon which to outline the Life History of this insect, but, in general, it probably is about as follows. The eggs most likely are deposited by the female puncturing the cocoon of Dryinus, during August; that is, soon after the cocoon is formed. A reason for thinking that the eggs are not deposited in the larva before it has made a cocoon, is that, if the female Cheiloneurus were to try depositing eggs in the Dryinus larva while the latter was still in the sack, upon the body of the Ormenis nymph, this latter would most likely make a sudden jump, as it is accustomed to do on being disturbed, and this would dislodge the adult Cheiloneurus before she had had time to deposit the four to six eggs within the Dryinus larva The Dryinus larva supplies just about enough food for five Cheiloneurus larvæ They very likely get their growth during the autumn; hibernate either in the larval or the pupal stage, and transform to adults early in spring. This would give time enough for more than one brood during the summer, providing its host also has more than one brood, or perhaps it is not unlikely that it finds some other host for an early summer brood

One interesting point in connection with this species, is its parasitizing another Hymenopterous form, whereas the other species of Cheiloneurus are parasitic upon Coccidæ, and the most of the members of the same group, Encyrtinæ, are parasitic upon various species of Coccidæ and Aphididæ

IV GONATOPUS BICOLOR ASHM

V. LABEO LONGITARSIS ASHM

Bull 45 U S National Museum, pp 85, 88, 1893

April 11, 1903, a nymph of Liburnia lutulenta was found infested with a parasite living in a sack protruding from the dorsal side of the abdomen (Plate 21, Fig 13) The next day the parasitic larva escaped from the host and spun a cocoon between fragments of grass leaves

April 14 and 20 about a dozen more similarly parasitized nymphs were obtained. In all of them the parasite had about completed its growth, and in a few days all had escaped from their hosts and spun cocoons The cocoons were white, and some were cylindrical and formed in the groove of upper surface of grass leaves, others were made on flat surface of the breeding jar, and were similar in form to those of Dryinus ormenidis (Plate 20, Fig 2), 5mm long and 3 mm wide

May 12, the first adult appeared It was a male Labeo longitarsis (Plate 21, Fig 12) May 14 a female Gonatopus bicolor appeared (Plate 21, Fig 11) These were both from cylindrical cocoons on grass leaves. May 17, another female G bicolor, and May 18 and 19, each, a male specimen of L longitarsis appeared These were all that completed the transformation. None of the females came from a cocoon like Fig 2, but one of the males did

These parasites evidently hibernate with their host, which hibernates in the nymphal stage.

The evidence from these observations is that L. longitarsis is the male of G. bicolor, just as shown in previous part of this paper, L. typhlocybæ is undoubtedly the male of D. ormenidis

In view of these observations and considerations, one can hardly escape the inference that the genus Labeo may, by further observations and rearing of larvæ of the different species be found to contain males of yet other genera of Dryininæ The same might be inferred of other genera of Dryininæ that have hitherto been known only as males Rearing larvaæ as above, or in more complete detail, will be helpful, or it may be said, in fact, necessary in properly associating the males and females of this subfamily and establishing their true generic and specific relationship.

In regard to the species under consideration, since G. bicolor and L longitarsis have the same date of description and since Gonatopus was the earlier of the two genera to be described, I would place the synonomy thus —

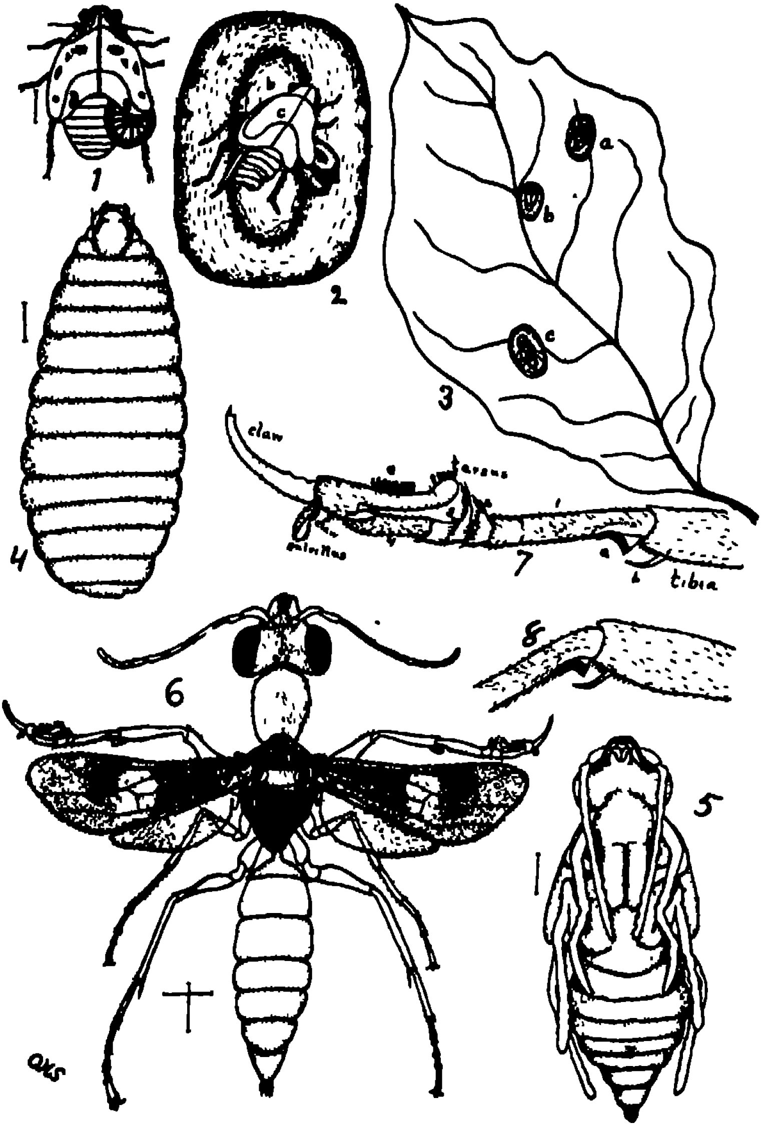
Gonatopus bicolor Ashm., Bul 45, U S Nat Mus., p 85, 1893
Labeo longitarsis Ashm , Bul 45, U S. National Mus , p 88, 1893

MORPHOLOGY OF THE CHELATE FORE-TARSUS OF THE FEMALES OF THE SUB-FAMILY DRYININÆ

This peculiar structure is shown Plate 20, Fig. 7 and Plate 21, Fig 14 It occurs in the females of nearly all the genera of the group. The fifth tarsal segment is enlarged and has a very peculiar elongate, backward extension from its outer side. This extends as far as to the proximal part of the second tarsal segment It is curved, slightly tapering till near the tip where it is somewhat enlarged. At the distal end of the fifth segment are borne two claws with a pulvillus between them. The inner claw is about normal size; but the outer one is greatly elongated and articulated with the fifth segment in such a way that it may close up with the prolongation forming a forceps or chela (Plate 21, Fig 14) The tip of the claw nearly reaches the tip of tarsal prolongation; it has a notch which forms a secondary tooth. At the tip of the tarsal prolongation and extending outward is a group of Indian-club-shaped appendages There are several of these also along its outer side, and a few on the claw as well

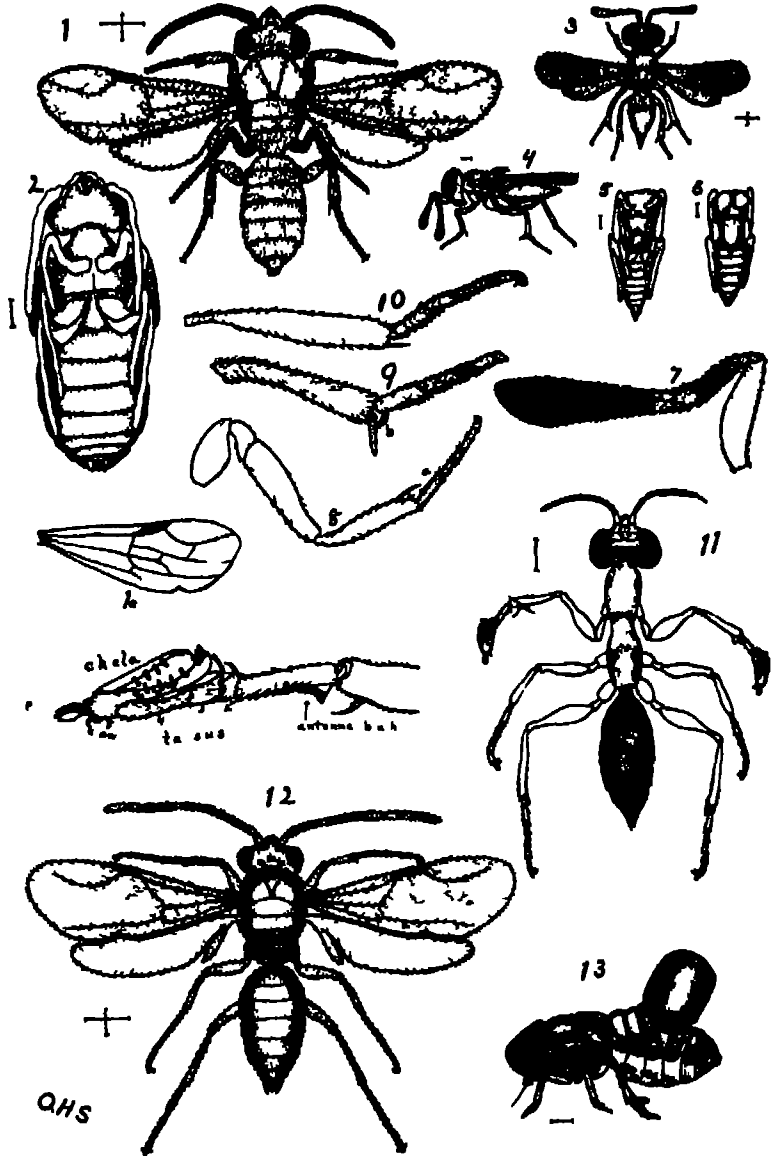
'This peculiar chelate tarsus is found in no other group among the Hymenoptera" (Ashmead). No observations were made which would give one a hint of the particular use of this chela May it be suggested, however, that it is used in some special manner in clinging to the host during the act of egg deposition. The members of the family Proctotrypidæ are chiefly egg parasites, but this particular group of the family are parasitic upon larvæ, principally of the families Fulgoridæ, Membracidæ, and

OHIO NATURALIST *Plate 21*



SWEZEY on "Observations on Hymenopterous Parasites of Certain Fulgoridae."

OHIO NATURALIST *Plate 21*



SWEZEY on 'Observations on Hymenopterous Parasites of Certain Fulgoridæ'

Jassidæ all of which have active jumping habits Hence this peculiar chela may have been developed for the special purpose of holding to the host larva while an egg is being deposited

EXPLANATION OF PLATE 20

Fig 1—Nymph of Ormenis septentrionalis showing the sack in which the larva of Dryinus ormenidis lives protruding from beneath the right wing pads x 5 Fig 2—Cocoon of D ormenidis *a* the flatter portion of it *b* the more convex portion which contains the pupa *c* exuvia of nymph of O septentrionalis *d* the empty sack from which the Dryinus larva has escaped x 5 Fig 3—Leaf upon which there are three cocoons *a* and *c* cocoons of D ormenidis surmounted by exuviæ *b* cocoon of Labeo typhlocybæ surmounted by larval sack natural size Fig 4 8—Dryinus ormenidis Fig 4—Larva x 10 Fig 5—Ventral view of pupa x 10 Fig 6 adult female x 10 Fig 7—tarsus of fore leg *a* antennal brush or comb on the first segment of tarsus *b* tibial spur which holds the antenna against the comb while being cleaned *c* peculiarly modified 5th tarsal segment x 37 Fig 8—Tarsus partly flexed at base to show how the spur comes into apposition and works with the antennal comb x 37

EXPLANATION OF PLATE 21

Fig 1—Adult male of Labeo typhlocybæ x 10 Fig 1*a*—Forewing of L typhlocybæ showing venation as it appeared shortly after transformation x 10 Fig 2—Ventral view of pupa of L typhlocybæ x 10 Figs 3 10—Cheiloneurus swezeyi Figs 3 4—Adult female x 10 Figs 5 6—ventral and dorsal views of pupa x 10 Fig 7—antenna x 50 Fig 8—fore leg at *a* antennal comb x 50 Figs 9 10—tibia and tarsus of second and third legs *b* movable spur x 50 Fig 11—female Gonatopus bicolor x 10 Fig 12—male Labeo longitarsis x 10 Fig 13—nymph of Liburnia lutulenta with parasitic larva in sack on its abdomen x 10 Fig 14—fore tarsus of female Gonatopus bicolor x 40

THE SOCIETY OF THE SIGMA XI

Among Greek letter societies the one which is of especial interest to students of science is the Society of the Sigma XI Its badge is now seen so frequently at meetings of scientific men that it is well to know exactly what it stands for In 1886 at Cornell University the first chapter was founded and the initial letters of the phrase meaning companions in zealous research made the name of the society Since this beginning it has grown especially during the last few years until now nearly every large university in the country has a chapter the most recent additions being Chicago and Michigan

It is an honor society open to men and women who have distinguished themselves in scientific or technical work By the constitution two standards are set up one relating to the eligibility of members of a college or university faculty and to alumni and one to students in the fourth year class The first standard calls for an actual contribution to science and the second for such scholarship and success in scientific or technical studies as to give promise of ability to carry on research work

At the Ohio State University which is the only institution in Ohio having a charter stress has always been laid on the election of seniors The machinery of election is such that it amounts to a careful canvass by their instructors of the members of the fourth year class to determine who give the greatest promise of ability to contribute to the knowledge of the world on their special subjects It is seen that to gain membership in Sigma XI is the highest academic honor that the student in science and technology can attain The Society is not a fraternity in the ordinary sense of the word There are no secrets and no grip In brief to know that a senior was elected to Sigma XI is simply to know that he was one of the best men in his class

C W FOULK *Secy O S U Chapter*

MEETING OF THE BIOLOGICAL CLUB

ORTON HALL April 13 1903

Mr Griggs presiding the program opened with the reading of minutes of last meeting

One of the members on the program being absent the time was occupied by Prof Haines in a review of Lloyd Morgan s book on Animal Behavior published some time since

Under reports of committees Dr Kellerman reported that Prof Pollard would give his lecture on May 4th The committee was instructed to continue preparations for the lecture and to prepare a program

The motion was carried that this meeting take the place of the regular club meeting of that date and a business meeting be held afterward

Under new business the following propositions to amend the constitution of THE NATURALIST were submitted by Prof Landacre

1 That the editorial staff shall consist of an editor in chief a managing editor or business manager and of associate editors representing the different branches of science represented in the Club

2 That the publication funds be secured by subscriptions (The price of the fourth volume to be one dollar for single subscriptions) by suitable advertisements and by the sale of exchanges

Messrs J B Hyde and Jas McOwen Jr were elected to membership

OTTO E JENNINGS *Sec pro tem*

On Monday May 11 at a special called meeting of the Club the amendments given above were adopted

ROBERT F GRIGGS *Secy*

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